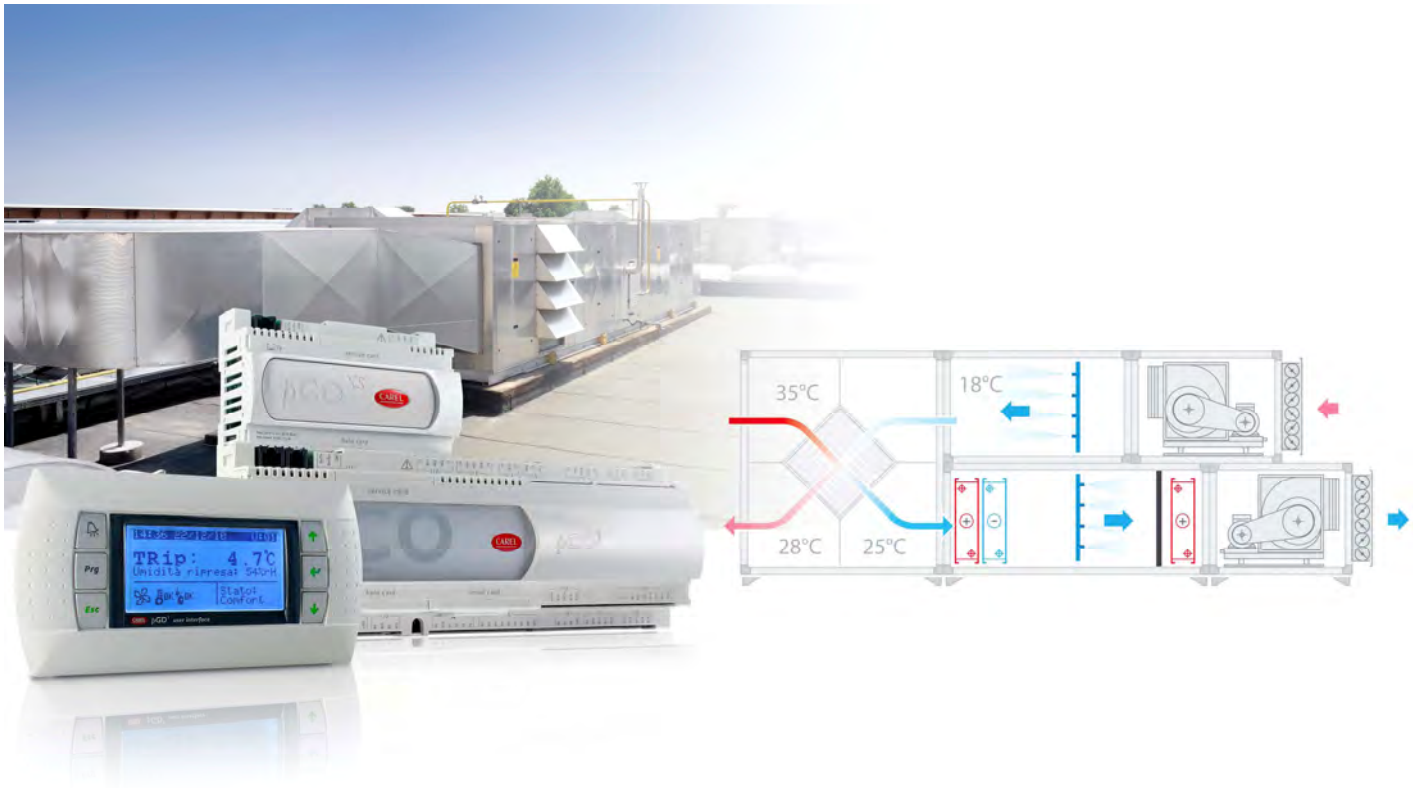
FLSTDMAHUE

Application for managing air handling units



ENG **User manual**

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Integrated Control Solutions & Energy Savings

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• do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual. ;
• do not attempt to open the device in any way other than described in the manual;
• do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged;
• do not use corrosive chemicals, solvents or aggressive detergents to clean the device;
• do not use the product for applications other than those specified in the technical manual.
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The technical specifications shown in the manual may be changed without prior warning.
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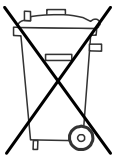
WARNING

Separate as much as possible the probe and digital input cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel cables) and signal cables in the same conduits.

DISPOSAL



The products are made from metal parts and plastic parts In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:
1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
3. the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

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1 INTRODUCTION

FLSTDMAHUE is an application program developed by CAREL for the management of air handling units (AHU). It runs on the pCO range of programmable controllers (pCO^3 small, medium, large or pCO^{XS} 1+1Mbyte (*)), selected according to the complexity of the unit, and the pGD1 terminal. Its main feature is its adaptability to many types of air handling unit, with different types of probes and actuators, on/off type or modulating. Moreover, the possibility to connect up to two pCOe serial options via RS485 card allows additional probes and outputs to be added, ensuring maximum flexibility. Alternatively, the MP-Bus® card can be used to connect up to 8 Belimo®, actuators each with its probe or digital input; this eliminates a lot of the wiring needed during installation. CAREL temperature, humidity and combined serial probes can be connected, for both rooms and ducts, as well as active differential pressure probes, flow switches and pressure switches to signal alarms following faults on fans or pumps. The supply and return air fans can be controlled by inverter based on static pressure or fixed speed. The control software can manage temperature or humidity as the priority, control an adiabatic or isothermal humidifier, freecooling/freeheating based on enthalpy and humidity recovery using a heat wheel. The commissioning procedure is based on the documented design of the air handling unit being controlled: the inputs and outputs can be assigned dynamically, meaning there is no fixed position for the various types of probes/actuators connected, with the software proposing the first position available for the type of input/output (e.g. a certain input can accept a passive NTC probe or active probe with 0 to 1 V or 4 to 20 mA output). The identification of the type of AHU being controlled is not based on the choice between a certain number of pre-configured units; rather the selection of the devices installed on the AHU (e.g. preheating / cooling / reheating coils, fans, pumps, inverter, heaters, dampers, humidifiers, heat recovery unit) and then setting their parameters. This simplifies configuration, as the user only sees the parameters relating to the components used. Changes can be made subsequently to the configuration without needing to start again from scratch.
(*) pCO^{XS} 1+1Mbyte in the 1tool programming environment is called pCO1XSE.

1.1 Main features

In summary:
• parameter settings divided by level, user, installer or manufacturer, with password-protected access;
• temperature and/or humidity control with differentiated set point in cooling and heating;
• automatic cooling/heating changeover;
• set point compensation in cooling and heating;
• selection of up to four daily time bands, with settings for each operating mode;
• holiday and special day function, with reduced set point;
• cascaded control of heating / cooling devices so as to maximise energy saving;
• operation in comfort, precomfort or economy mode, if time bands are enabled;
• management of pumps, including in tandem, for preheating cooling/reheating coils, with rotation, backup, overload alarms and anti-blocking for each pump;
• minimum water temperature limit settable for opening the coil valves;
• dehumidification by cooling (including with dewpoint control - dewpoint) and reheating coil;
• bands for activating the preheating and reheating devices can be overlapped to supplement each other;
• ON/OFF or modulating control of isothermal or adiabatic humidifiers;
• "freecooling" and "freeheating" based on temperature or enthalpy;
• heat recovery with cross-flow heat recovery unit, run-around coil or heat wheel, based on temperature or enthalpy;
• control by inverter of fans at constant pressure or constant speed;
• management of fans, including in tandem, with rotation and backup functions;
• air quality control with CO2 and VOC (volatile organic compounds) probes;
• safety protectors for antifreeze, dirty filters, smoke/fire, no air or water flow, humidifier alarm, inverter alarm, open door alarm;
• unit antifreeze and room protection;
• up to 4 independent auxiliary control loops, each with its own PI control and control probe (for example to manage a second humidifier);
• input/output test to check correctness of wiring during installation;
• connection via FieldBus port and corresponding RS485 serial card (accessory) to serial probes, inverters, pCOe expansion card;
• connection via BMS port and corresponding RS485 serial card (accessory) to a supervisory system (PlantVisorPro, PlantWatch…), transferring the readings of 4 probes.

1.2 Accessories available for FLSTDMAHUE

Below is a list of devices suitable for use with FLSTDMAHUE.
CAREL features passive, active and serial temperature, humidity and differential pressure probes, for room or duct installation, specifically for the air handling unit appliance. See the CAREL price list for the complete list.

1.2.1 Room temperature and humidity sensor

TEMPERATURE SENSORS

Code	Type	Range
DPWT011000	NTC	-10T60°C
DPWT010000	0 to 1 V, 4 to 20 mA	
DPWT014000	Opto RS485 serial	

TEMPERATURE AND HUMIDITY SENSORS

Code	Type	Range
DPWC112000	0 to 10 V, 0 to 10 V	-10T60°C, 10 to 90% RH
DPWC115000	NTC, 0 to 10 V	
DPWC110000	0 to 1 V, 4 to 20 mA	
DPWC114000	Opto RS485 serial	
DPWC111000	NTC, 0 to 1 V, 4 to 20 mA	
DPPC112000	0 to 10 V, 0 to 10 V	-10T60°C, 10 to 90% RH
DPPC110000	0 to 1 V, 4 to 20 mA	
DPPC111000	NTC, 0 to 1 V, 4 to 20 mA	

1.2.2 Duct temperature and humidity sensor

TEMPERATURE SENSORS

Code	Type	Range
DPDT011000	NTC	-20T70°C
DPDT010000	0 to 1 V, 4 to 20 mA	
DPDT014000	Opto RS485 serial	-20T60°C

TEMPERATURE AND HUMIDITY SENSORS

Code	Type	Range
DPDC112000	0 to 10 V, 0 to 10 V	-10T60°C, 10 to 90% RH
DPDC110000	0 to 1 V, 4 to 20 mA	
DPDC111000	NTC, 0 to 1 V, 4 to 20 mA	
DPDC114000	Opto RS485 serial	

1.2.3 NTC temperature sensors

Code	Type	Range
NTC*HP*	10 kΩ±1%@25 °C, IP67	-50 to 105/50°C (air/fluid)
NTC*WF*	10 kΩ±1%@25 °C (Fast), IP67	-50 to 105°C (fast)
NTC*WP*	10 kΩ±1%@25 °C, IP68	-50 to 105°C
NTC*HF*	10 kΩ±1%@25 °C, strap-on, IP67	-50 to 90°C
NTC*HT*	50 kΩ±1%@25 °C, IP55	0 to 150°C (air)
NTC*HT*	50 kΩ±1%@25 °C, stainless steel cap, IP55	0 to 150°C (air)

1.2.4 Room air quality sensors

DPWQ*

DPDQ*

CO_2 SENSORS

Code	Range	Output
DPWQ402000	0 to 2000 ppm	0 to 10 V
DPDQ402000	0 to 2000 ppm	0 to 10 V

CO_2 & VOC SENSORS

Code	Range		Output
	CO2	VOC	
DPWQ502000	0 to 2000 ppm	0 to 100 %	0 to 10 V, 0 to 10 V
DPDQ502000	0 to 2000 ppm	0 to 100 %	0 to 10 V, 0 to 10 V

1.2.5 Differential air pressure sensors

Code	Range	Output
SPKT00C5N0	0 to 0.5 mbar	4 to 20 mA
SPKT0065N0	0 to 10 mbar	4 to 20 mA
SPKT0075N0	0 to 25 mbar	4 to 20 mA

1.2.6 Differential air pressure switches/flow switches

PRESSURE SWITCHES

Code	Range	Output
DCPD000100	0.5 to 5 mbar	ON/OFF
DCPD001100	0.2 to 2 mbar	ON/OFF

FLOW SWITCHES

Code	Range	Output
DCFL000100	1 to 9 m/s	ON/OFF

1.2.7 Smoke and fire sensors

Code	Type	Output
SFFS000000	Smoke detector, 24 Vdc PS	ON/OFF
SFFF000000	Fire detector, 24 Vdc PS	ON/OFF

1.2.8 USB /RS485 converter code CVSTDUTLF0/ CVSTDUMOR0

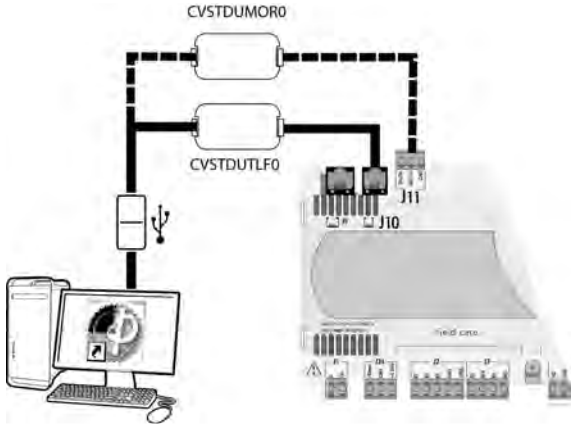
The USB/RS485 converter code CVSTDUTLF0 is used to connect a personal computer running the pCO Manager program to the pLAN port (J10) on the pCO controller, via a telephone connector. Alternatively, converter code CVSTDUMOR0 connects to the pLAN port (J11) or the BMS port, fitted with a special serial card. Once the connection has been made, the application program software can be loaded and the parameters set. See chapters "Software installation" and "Appendix".

CVSTDUTLFO

CVSTDUMOR0

1.2.9 pCO Manager

This program, downloadable from http://ksa.carel.com, is used to modify the parameters based on the application, save them and then copy the settings directly to the application. The USB/RS485 converters codes CVSTDUTLF0/CVSTDUMOR0 must be connected between the computer and the RS485 port on the pCO, to terminals J10/J11 respectively.



1.2.10 Smart key code PCOS00AKY0

The Smart key is an electronic device used to program and service the pCO family controllers. It simplifies the transfer of data between the controllers installed and a personal computer by exploiting the high capacity flash memory for storing software applications, BIOS and variable logs. The pCO is connected directly via the telephone connector using the cable supplied, while to transfer the data to a personal computer, the USB adapter code PCOS00AKC0 is required. The power supply comes either via the USB port on the PC or from the controller, therefore no external power supply is needed.

Smart key

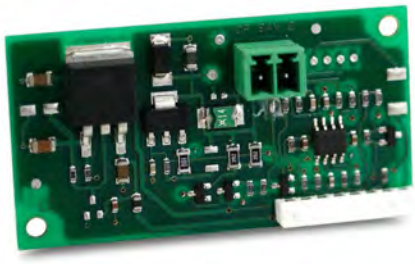
PCOS00AKC0

1.2.11 Optically-isolated fieldbus RS485 card code PCO100FD10

This card is used to connect the Fieldbus serial port on the pCO to an RS485 network. It is installed in the slot marked "field card", when needing to connect serial probes, CAREL VFD inverters or pCOe expansion cards.

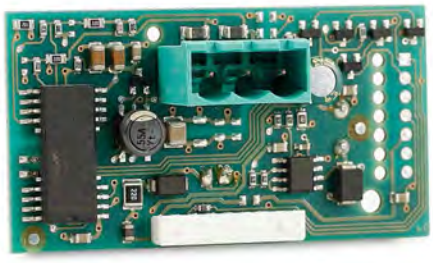
1.2.12 Belimo MP-BUS card code PCO100MPB0

This card connects the pCO to an MP-Bus network of I/O devices that use the Belimo® standard. Up to 8 actuators can be connected at the same time, over a maximum distance of 30 m. It is installed in the slot marked "field card".



1.2.13 BMS 485/Modbus card code PCOS004850

This optically-isolated card connects the BMS serial port to an RS485 network, for example to run the commissioning procedure from a personal computer installed with pCO Manager. It is installed in the slot marked "serial card". Once commissioning has been completed, it can be replaced with one of the cards listed in the table.



BMS cards	Code
Ethernet card	PCO1000WB0
BACnet MS/TP 485 card	PCO1000BA0
Konnex	PCOS00KXB0
LON	PCO10000F0

1.2.14 pGD1 terminal

The pGD1 graphic display is an electronic device that allows graphics management using the icon-based display as well as supporting international fonts.

1.2.15 VFD inverter

CAREL VFD inverters are available in various sizes for controlling fans at constant pressure or fixed speed. See "Connecting the VFD inverter".

1.2.16 pCOe expansion card

The expansion card code PCOE004850 is an electronic device, part of the pCO sistema family, designed to increase the number of inputs and outputs available on pCO controllers.

1.2.17 Belimo® actuators

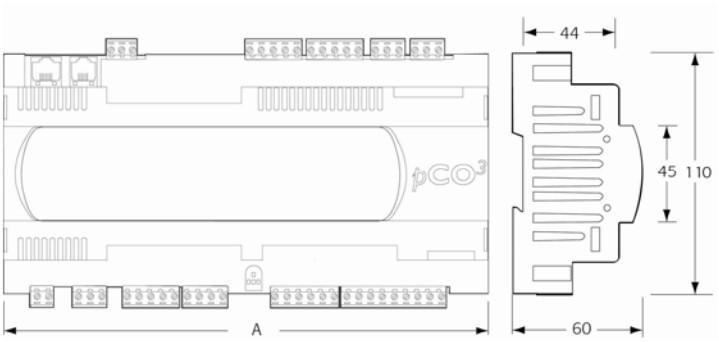
The MP- Bus card can be used to control up to 8 Belimo® valve and damper actuators, each where necessary with their probe or digital input, meaning significant savings in wiring required during installation.

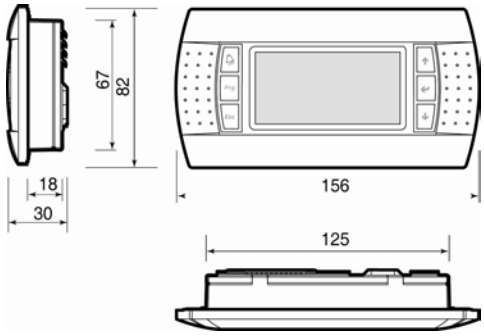
1.2.18 Analogue output module (code CONV0/10A0)

This converts the PWM signal for solid state relays (SSR) into a standard 0 to 10 Vdc or 4 to 20 mA signal. For pCO^{XS} 1+1Mbyte models only (output Y3).

2 HARDWARE INSTALLATIO

2.1 DIN rail assembly and dimensions

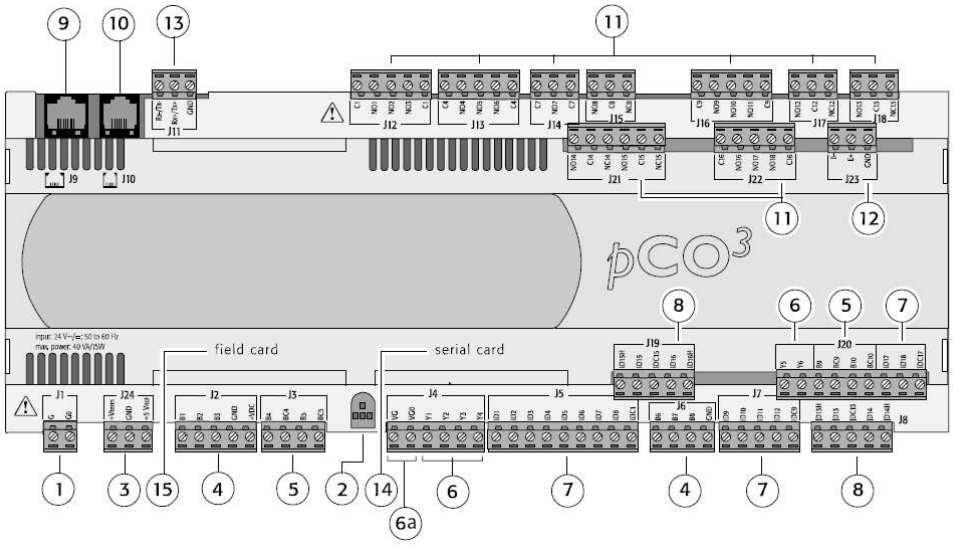




	pCO3 SMALL	pCO3 MEDIUM	pCO3 LARGE	pCO^{XS} 1+1Mbyte
A(mm)	227.5	315	315	140

pGD1

2.2 Description of the terminals on the pCO Large



Key

1	power supply connector	G(+), G0(-)
2	yellow power LED and 3 status LEDs	
3	additional power supply for terminal	+Vterm, GND, +5 VREF
4	universal NTC analogue inputs, 0 to 1 V, 0 to 10 V, 4 to 20 mA	B1, B2, B3, GND, +VDC and B6, B7, B8, GND
5	passive NTC analogue inputs, PT1000, ON/OFF	B4, BC4, B5, BC5 and B9, BC9, B10, BC10
6	0 to 10 V analogue outputs	Y1, Y2, Y3, Y4 and Y5, Y6
6a	power to optically-isolated analogue output, 24 Vac/Vdc	VG, VG0
7	24 Vac/Vdc digital inputs	ID1, ID2, ID3, ID4, ID5, ID6, ID7, ID8, IDC1, and ID9, ID10, ID11, ID12, IDC9 and ID17, ID18, IDC17
8	230 Vac or 24 Vac/Vdc digital inputs	ID13H,ID13, IDC13, ID14, ID14H and ID15H, ID15, IDC15, ID16, ID16H
9	reserved	
10	connector for the standard pCO series terminals and for downloading the application program	
11	relay digital outputs	C1, NO1, NO2, NO3, C1 and C4, NO4, NO5, NO6, C4 and C7, NO7, C7 and NO8, C8, NC8 and C9, N09, N10, NO11, C9 and NO12, C12, NC12 and NO13, C13, NC13 and NO14, C14, NC14, NO15, C15, NC15 and C16, NO16, NO17, NO18, C16
12	reserved	E-, E+, GND
13	pLAN network connector	Rx-/Tx-, Rx+/Tx+, GND
14	cover for inserting the BMS card for supervisor and telemaintenance connection	
15	cover for inserting the RS485 or MP-Bus card	

Models and features	pCO³SMALL	pCO³MEDIUM	pCO³LARGE	pCO^{XS} 1+1Mbyte	pCOe (expansion card)
No. of analogue inputs	5	8	10	4	4
No. of digital inputs	8	14	18	6	4
No. of analogue outputs	4	4	6	2 + 1 PWM	1
No. of digital outputs	8	13	18	5	4

2.3 Installation

Installation instructions

Important:

Environmental conditions

Avoid assembling the pCO board and the terminal in rooms with the following characteristics:

• temperature and humidity that do not conform to the rated operating data of the product;
• strong vibrations or knocks;
• exposure to aggressive and polluting atmospheres(e.g.: sulphur and ammonia fumes, saline mist, smoke) so as to avoid corrosion and/or oxidation;
• strong magnetic and/or radio frequency interference (therefore avoid installing the units near transmitting antennae);
• exposure of the pCO board to direct sunlight and to the elements in general;
• large and rapid fluctuations in the room temperature;
• environments where explosives or mixes of flammable gases are present;
• exposure to dust (formation of corrosive patina with possible oxidation and reduction of insulation).

Positioning inside the panel

The position of the controller in the electrical cabinet must be chosen so as to guarantee correct physical separation from the power components (solenoids, contactors, actuators, inverters, ...) and the connected cables. Proximity to such devices/cables may create random malfunctions that are not immediately evident. The structure of the panel must allow the correct flow of cooling air

Important:

Wiring instructions

Important: when laying the wiring, "physically " separate the power part from the control part. The proximity of these two sets of wires will, in most cases, cause problems of induced disturbance or, over time, malfunctions or damage to the components. The ideal solution is to house these two circuits in two separate cabinets. Sometimes this is not possible, and therefore the power part and the control part must be installed in two separate areas inside the same panel. For the control signals, it is recommended to use shielded cables with twisted wires. If the control cables have to cross over the power cables, the intersections must be as near as possible to 90 degrees, always avoiding running the control cables parallel to the power cables. CAREL highlights the following warnings:

• use cable ends suitable for the corresponding terminals. Loosen each screw and insert the cable ends, then tighten the screws. When the operation is completed, slightly tug the cables to check they are sufficiently tight;
• separate as much as possible the sensor signal, digital input and serial line cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never insert power cables (including the electrical cables) and probe signal cables in the same conduits. Do not install the sensor cables in the immediate vicinity of power devices (contactors, circuit breakers or similar);
• reduce the path of the sensor cables as much as possible, and avoid spiral paths that enclose power devices;
• avoid touching or nearly touching the electronic components fitted on the boards to avoid electrostatic discharges (extremely damaging) from the operator to the components;
• do not secure the cables to the terminals by pressing the screwdriver with excessive force, to avoid damaging the pCO controller;
• for applications subject to considerable vibrations (1.5 mm pk-pk 10/55 Hz), secure the cables connected to the pCO around 3 cm from the connectors using clamps;
• if the product is installed in industrial environments (application of the EN 61000-6-2 standard) the length of the connections must be less than 30 m;
• all the extra low voltage connections (analogue and 24 Vac/Vdc digital inputs, analogue outputs, serial bus connections, power supplies) must have reinforced or double insulation from the mains network;
• in residential environments, the connection cable between the pCO controller and the terminal must be shielded;
• there is no limit to the number of cables that can be connected to an individual terminal. The only limitation concerns the maximum current crossing each terminal: this must not exceed 8 A;
• the maximum cross-section of the cable that connected to a terminal is 2.5 mm2 (12 AWG);
• the maximum value of the twisting torque to tighten the screw on the terminal (torque tightening) is 0.6 Nm;
• installation must be performed according to the standards and legislation in force in the country where the device is used;
• for safety reasons the equipment must be housed inside an electrical panel, so that the only accessible part is the display and the keypad;
• in the event of malfunctions, do not attempt to repair the device, but rather contact the CAREL service centre.

Anchoring the pCO board

The pCO is installed on a DIN rail. To fasten the unit to the DIN rail, press it lightly against the rail. The rear tabs will click into place, locking the unit in place. Removing the unit is just as simple, using a screwdriver through the release slot to lever and lift the tabs. These are kept in the locked position by springs.

Power supply

Power supply t the pCO³ board (co controller with terminal connected): 2828 to 36 Vdc +10/-20% or 24 Vac +10/-15% 50 / 60 Hz; Maximum power P= 15 W (power supply Vdc), P= 40 VA (Vac).

• power supply other than that specified will seriously damage the system;
• a Class 2 safety transformer, rating 50 VA, must be used in the installation to supply just one pCO controller (30 VA for PCO1XSE);

the power supply to the pCO controller and terminal (or pCO controllers and terminals) should be separated from the power supply to the other electrical devices (contactors and other electromechanical components) inside the electrical panel;

• if the power transformer secondary is earthed, check that the earth wire is connected to terminal G0. This applies to all the devices connected to the pCO;
• if more than one pCO board is connected in a pLAN network, make sure that the G and G0 references are observed (G0 must be maintained for all boards);
• a yellow LED indicates that the pCO board is powered.

2.4 Connection of the analogue inputs

Note: FLSTDMAHUE filters the type of analogue inputs according to the type of unit selected. The analogue inputs on the pCO board can be configured for the more common sensors on the market: NTC, PT1000, 0 to 1 V, 0 to 10 V, 4 to 20 mA. The different types of probes can be selected by setting the inputs on the screens in menu Hb: I/O configuration. See chapter 6.

Connecting active temperature and humidity probes

The pCO controller can be connected to all the CAREL DP* series active temperature and humidity probes configured as 0 to 1 V or as 4 to 20 mA. For the temperature probes use the 4 to 20 mA or NTC configuration, as the 0 to 1 Vdc signal is limited to the range 0 to 1 V and therefore is not always compatible with the standard 10 mV/°C signal of CAREL probes (for negative temperatures and temperatures above 100 °C a probe alarm may be generated). The inputs must be pre-configured on the screens in menu Hb: I/O configuration.

Terminals		Probe terminals	Description
pCO	pCO^{XS} 1+1Mbyte		
GND	GND	M	Reference
+Vdc	+24Vdc	+G	Power supply
B1, B2, B3, B6, B7, B8	B1,B2	out H	Active humidity output
B1, B2, B3, B6, B7, B8	B1,B2	out T	Active temperature output

Note: for connection of the serial probes see chapter 6.

Connecting universal NTC temperature probes

All analogue inputs are compatible with 2-wire NTC sensors. The inputs must be pre-configured on the screens in menu Hb: I/O configuration.

Terminals		NTC probe wire
pCO	pCO^{XS} 1+1Mbyte	
GND, BC4, BC5, BC9, BC10	GND	1
B1, B2, B3, B4, B5, B6, B7, B8, B9, B10	B1, B2, B3, B4	2

Connecting PT1000 temperature probes

Important: pCOXS 1+1Mbyte does not allow connection of the PT1000 probe.

The pCO controller can be connected to 2-wire PT1000 sensors for all high temperature applications; the operating range is -50 to 200 °C. The inputs must be pre-configured on the screens in menu Hb: I/O configuration.

Controller	probe 1	probe 2	probe 3	probe 4	PT1000 probe wire
pCO3	BC4	BC5	BC9	BC10	1
	B4	B5	B9	B10	2

Connecting current pressure probes

The pCO can be connected to all CAREL SPKT****C0 series active pressure probes or any pressure probe available on the market with 4 to 20 mA signal. The inputs must be pre-configured on the screens in menu Hb: I/O configuration.

Controller	pCO terminals	Probe
pCO3	+Vdc	power supply
	B1, B2, B3, B6, B7, B8	signal

Connecting active probes with 0 to 10 V output

Important: pCOXS 1+1Mbyte does not allow direct connection to active probes with 0 to 10 V output. See the pCO sistema manual for the instructions on connecting an external resistor.

The inputs must be pre-configured on the screens in menu Hb: I/O configuration.

pCO terminals	0 to 10 V probe wire
GND	reference
B1, B2, B3, B6, B7, B8	signal

Remote connection of analogue inputs

The sizes of the cables for the remote connection of the analogue inputs are shown in the following table:

Type of input	size (mm^2) for length up to 50 m	size (mm^2) for length up to 100 m
NTC	0.5	1.0
PT1000	0.75	1.5
I (current)	0.25	0.5
V (live)	1.5	not recommended

Note: If the product is installed in industrial environments (application of the EN 61000-6-2 standard) the length of the connections must be less than 30 m. This length shouldn't be exceeded in any case, to avoid measurement errors.

2.5 Connecting the digital inputs

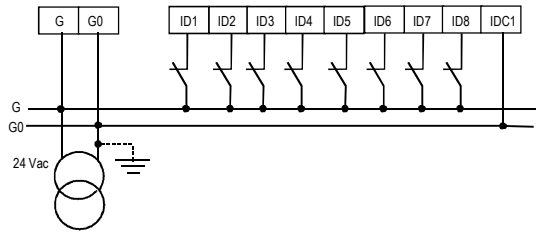
The pCO controller features digital inputs for connecting safety devices, alarms, device status and remote switches. These inputs are all optically isolated from the other terminals. They can work at 24 Vac, 24 Vdc and some at 230 Vac.

Note: separate the probe signal and digital input cables as much as possible from the inductive load and power cables, to avoid possible electromagnetic disturbance.

24 Vac digital inputs

On the pCO3 all inputs can be 24 Vac.

The following figure represents one of the most common connection diagrams for the 24 Vac digital inputs.



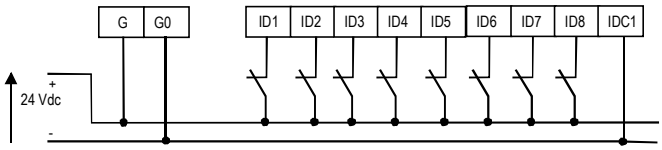
Note: the connection diagrams shown in these figures, which while being the most common and convenient, do not exclude the possibility of powering the digital inputs independently from the power supply to the pCO board.

In any case, the inputs only have functional insulation from the rest of the controller.

24 Vdc digital inputs

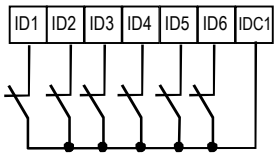
On the pCO3 all inputs can be 24 Vdc.

The following figure represents one of the most common connection diagrams for the 24 Vdc digital inputs.



2.5.1 Connecting the digital inputs for pCOXS 1+1Mbyte

pCO^{XS} 1+1Mbyte features up to 6 digital inputs, not optically-isolated, with voltage-free contacts, for connecting safety devices, alarms, device status, remote switches, etc.; these operate at 24 Vdc (supplied by pCO^{XS} 1+1Mbyte) with guaranteed contact current of 6 mA.

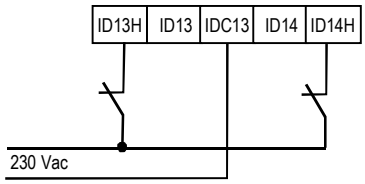


230 Vac digital inputs

Important: pCOXS 1+1Mbyte does not allow 230 Vac digital inputs.

There are up to two groups of inputs powered at 230 Vac; each group has two inputs. The groups feature double insulation between them and can refer to different voltages. Within each group the digital inputs are not independent, however: for example the inputs ID13H and ID14H, due to the common terminal, must be powered at the same voltage to avoid dangerous short-circuits and/or the powering of lower-voltage circuits at 230 Vac. In any case, the inputs feature double insulation from the rest of the controller.

	input
pCO3 terminals	ID13H, ID14H, ID15H, ID16H



The range of uncertainty of the switching threshold is from 43 to 90 Vac. It is recommended to use a 100 mA fuse in series with the digital inputs.

Remote connection of digital inputs

Important: do not connect other devices to the digital inputs. The sizes of the cables for the remote connection of the digital inputs are shown in the following table:

size (mm²) for length up to 50 m	**size (mm²) for length up to 100 m**
0.25	0.5

Note: if the product is installed in industrial environments (application of the EN 61000-6-2 standard) the length of the connections must be less than 30 m. This length shouldn't be exceeded in any case, to avoid measurement errors.

2.6 Connecting the analogue outputs

Connecting the 0 to 10 V analogue outputs

The pCO controller provides 0 to 10 V optically-isolated analogue outputs, powered externally at 24 Vac/Vdc. The table below shown summarises the distribution of the analogue outputs according to the version available.

Model	**Terminals**	**reference**
pCO small	Y1, Y2, Y3, Y4	VG0
pCO medium	Y1, Y2, Y3, Y4	VG0
pCO large	Y1, Y2, Y3, Y4,Y5, Y6	VG0
pCO^{XS} 1+1Mbyte	Y1, Y2	G0

2.7 Connecting the digital outputs

The pCO controller features digital outputs with electromechanical relays. For ease of installation, the common terminals of some of the relays have been grouped together.

Electromechanical relay digital outputs

The relays are divided into groups, according to the insulation distance. Inside each group, the relays have just basic insulation and thus must have the same voltage (generally 24 V ac or 110 to 230 Vac). Between the groups there is double insulation and thus the groups can have different voltages. There is also double insulation from the rest of the controller.

Model	**Reference for relays with same insulation**			
	Group 1	**Group 2**	**Group 3**	**Group 4**
pCO small	1 to 7	8		
Type of relay	Type A	Type A		
pCO medium	1 to 7	8	9 to 13	
Type of relay	Type A	Type A	Type A	
pCO large	1 to 7	8	9 to 13	14 to 18
Type of relay	Type A	Type A	Type A	
pCO^{XS} 1+1Mbyte	1 to 3	4	5	
Type of relay	Type A	Type A	Type A	

Relay ratings	SPDT, 2000 VA, 250 Vac, 8 A resistive	
Approval	UL873	2.5 A resistive, 2 A FLA, 12 A LRA, 250 Vac, C300 pilot duty (30000 cycles)
	EN 60730-1	2 A resistive, 2 A inductive, cosφ=0.6, 2(2)A (100000 cycles)

Remote connection of digital outputs

The sizes of the cables for the remote connection of the digital outputs are shown in the following table:

AWG	**Size (mm²)**	**Current (A)**
20	0.5	2
15	1.5	6
14	2.5	8

If the product is installed in industrial environments (application of the EN 61000-6-2 standard) the length of the connections must be less than 30 m.

Note: for further details and for the connection diagrams, see the pCO sistema manual (+030220335).

2.8 Connecting the fan inverter via analogue input

To connect the inverter for fan control to the serial network, see paragraph 6.7. Alternatively, the fan inverter can be connected even if the MP-Bus card is used to control Belimo® actuators. Connect the modulating analogue output on the pCO (e.g. Y4), the alarm signal digital input (e.g. ID2) and the enabling signal digital output (e.g. NO1). The inputs must be pre-configured on the screens in menu Hb: I/O configuration. The figure illustrates the connection to the Carel VFD-NXL; for other inverters, see the corresponding manual.

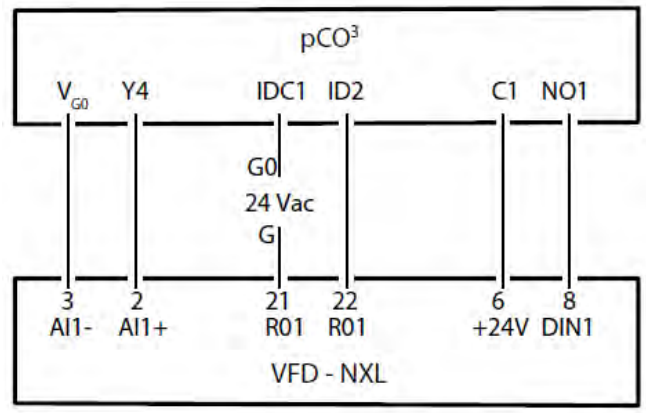
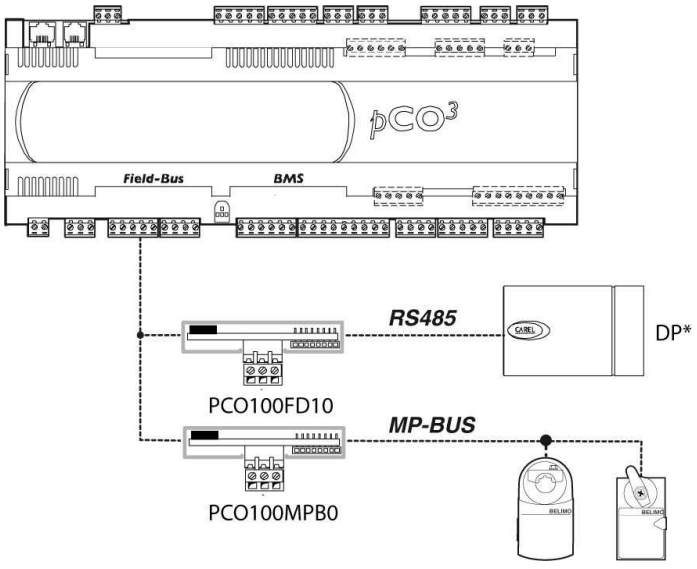


Fig. 2.g

Note: for further details and for the complete connection diagrams, see the dedicated VFD_NXL manual (+030220720) and the programming manual code +030220725.

2.9 Connecting serial devices with Modbus/Belimo® protocol.

See paragraphs 6.6 and 6.8. The serial probes must be installed according to the following diagram, and require the field serial card PCO100FD10 to be inserted in the special slot ("Field-Bus"). The power supply must be 24 Vac. To connect Belimo® devices, use card PCO100MPB0. The following figure shows two alternative connection possibilities.



2.10 Remote terminal with pLAN network

If the pCO boards are connected in a pLAN network, the terminal can be installed up to 50 m away, using a telephone cable, while if using a shielded twisted pair cable, TCONN6J000 and separate power supply, it can be installed up to 500 m away.

Note: if the terminal is used in a residential environment the cable must always be shielded. The maximum distance between the pCO and the user terminal is shown in the following table:

type of cable	power supply distance	power supply
telephone	50 m	taken from pCO (150 mA)
AWG24 shielded cable	200 m	taken from pCO (150 mA)
AWG20/22 shielded cable	500 m	separate power supply via TCONN6J000

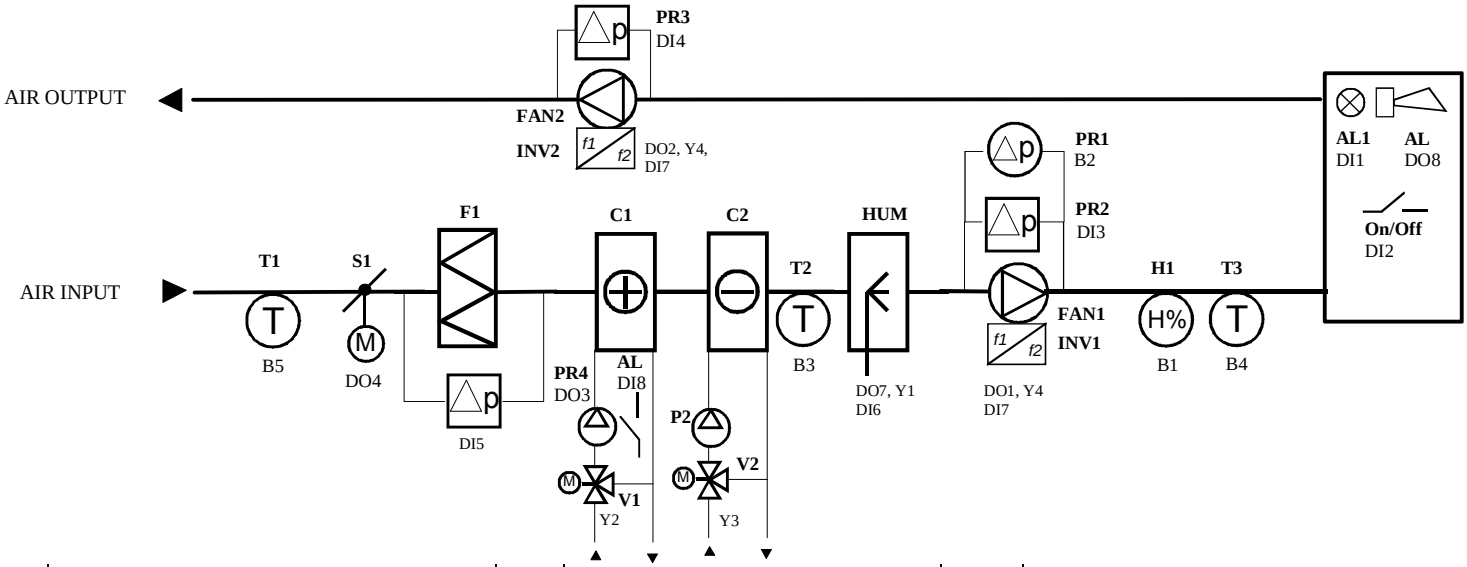
The maximum distance between two pCO3 controllers with AWG20/22 shielded cable is 500 m.

Note: for further details and for the connection diagrams, see the pCO sistema manual (+030220335).

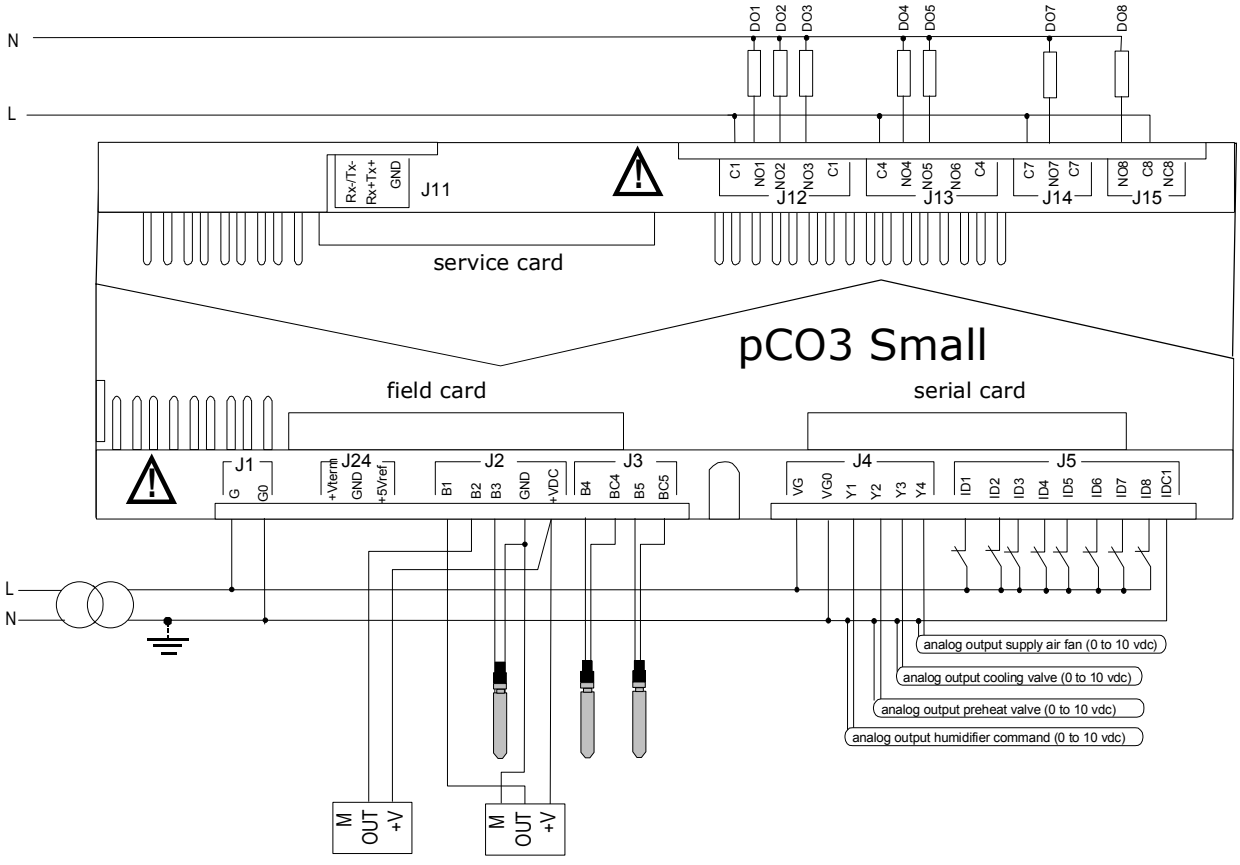
2.11 Connection diagrams

The following paragraphs show the functional and wiring diagrams for the air handling unit (AHU) managed by the various pCO boards, according to the corresponding default parameters.
Where possible, the symbols used refer to the following standards:
- UNI 9511-1;
- UNI 9511-3.

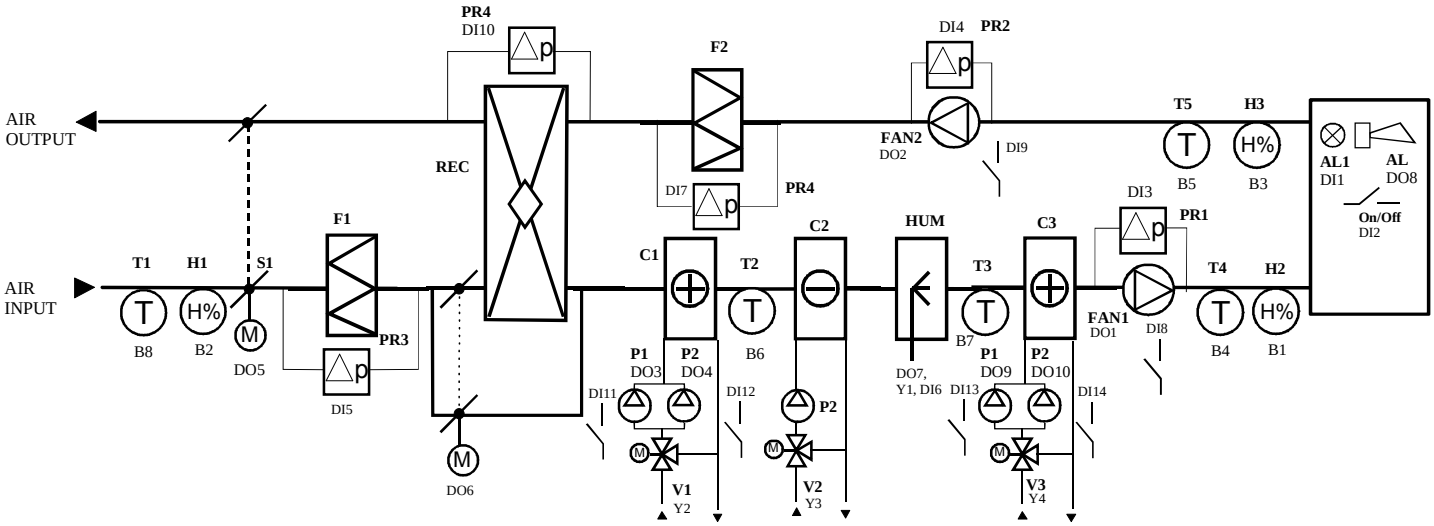
2.11.1 pCO3 Small



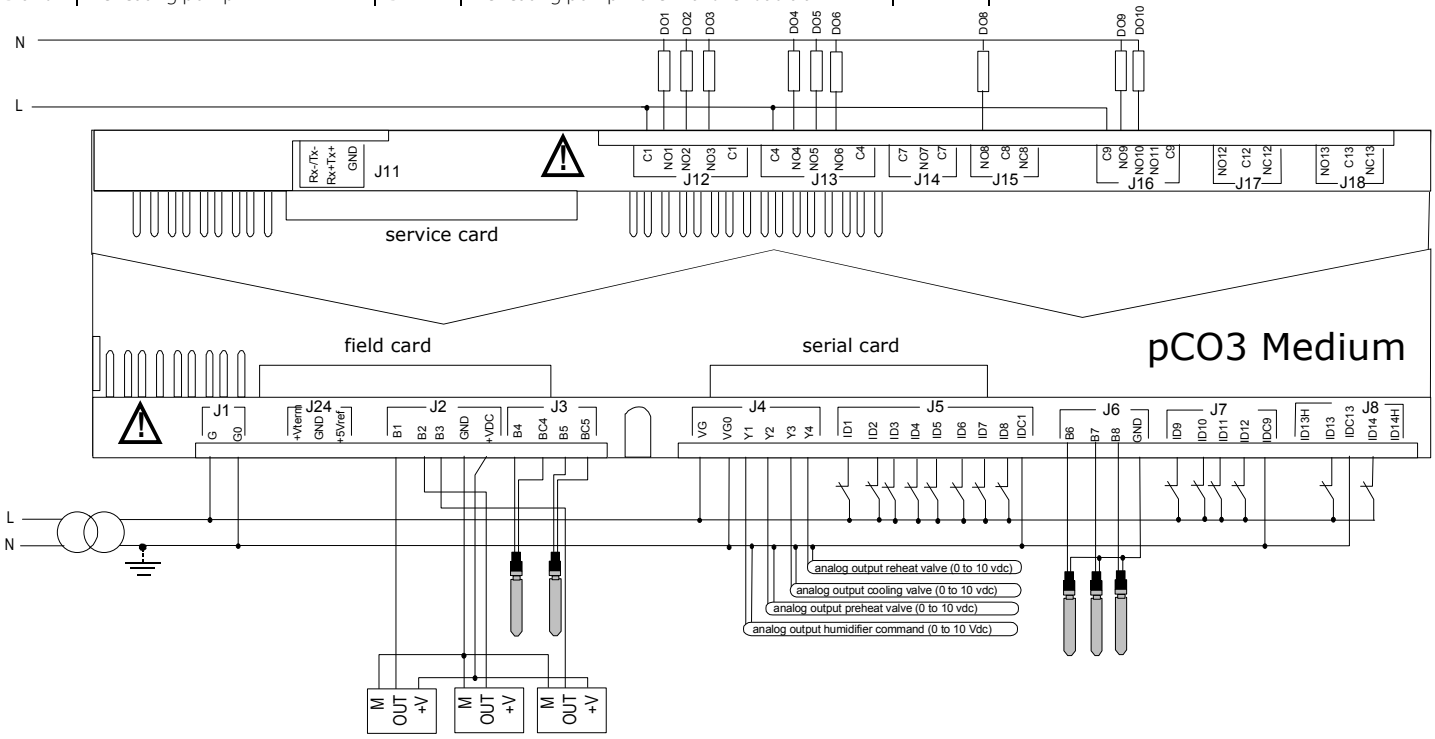
AI	Analogue inputs	AO	Analogue outputs		
B1	Supply humidity	Y1	Humidifier	P1	Preheating coil pump
B2	Differential pressure outlet air	Y2	Preheating valve	P2	Cooling coil pump
B3	Frost protection temperature	Y3	Cooling valve	T	Temperature probe
B4	Supply temperature	Y4	Supply fan	H	Humidity probe
B5	Outside temperature			INV1	Supply fan inverter
DI	**Digital inputs**	**DO**	**Digital outputs**	INV2	Return fan inverter
DI1	Generic alarm	DO1	Supply fan	C1	Preheating coil
DI2	Remote ON/OFF	DO2	Return fan	C2	Cooling coil
DI3	Supply air flow alarm	DO3	Preheating pump 1	PR	Differential pressure switch/probe
DI4	Return air flow alarm	DO4	Outside air damper	HUM	Humidifier
DI5	Supply air filter alarm	DO5	Filter alarm (not indicated)	F1, F2	Filters
DI6	Humidifier alarm	DO7	Humidifier	AL	General alarm
DI7	Supply (return) fan inverter alarm	DO8	General alarm	AL1	General alarm
DI8	Preheating pump thermal overload alarm			S1	Outside damper



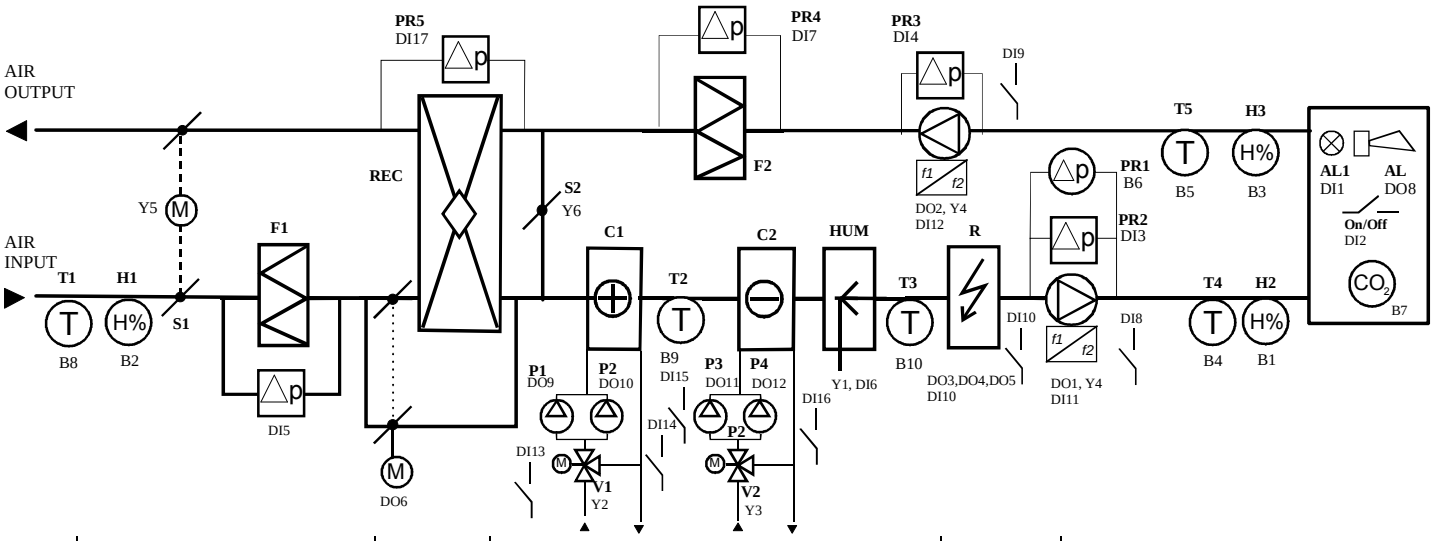
2.11.2 pCO3 Medium



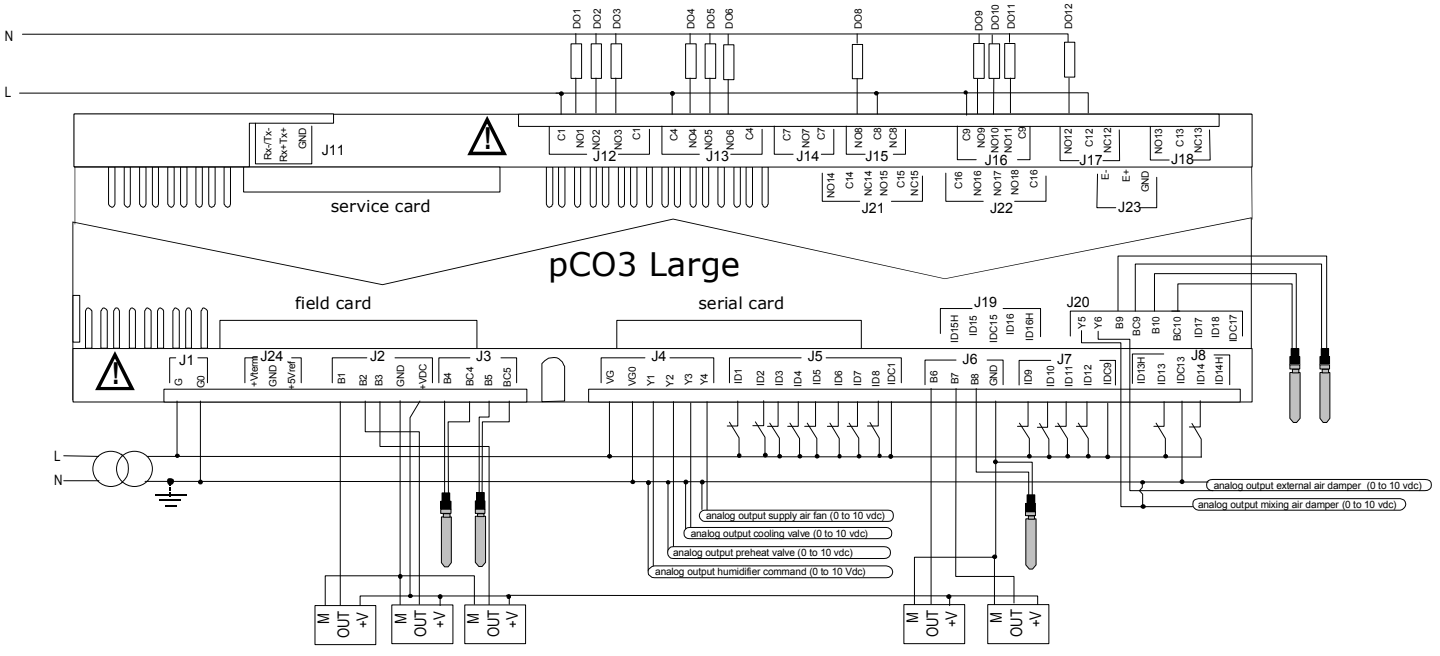
AI	Analogue inputs	AO	Analogue outputs		
B1	Supply humidity	Y1	Humidifier	P1	Preheating pump 1
B2	Outside humidity	Y2	Preheating valve	P2	Cooling pump
B3	Return humidity	Y3	Cooling valve	T	Temperature probe
B4	Supply temperature	Y4	Reheating valve	H	Humidity probe
B5	Return temperature	**DI**	**Digital inputs**	C1	Preheating coil
B6	Frost protection temperature	DI1	Generic alarm	C2	Cooling coil
B7	Saturation temperature	DI2	Remote ON/OFF	PR	Differential pressure switch/probe
B8	Outside temperature	DI3	Supply air flow alarm	HUM	Humidifier
DO	**Digital outputs**	DI4	Return air flow alarm	F1, F2	Filters
DO1	Supply fan	DI5	Supply air filter alarm	AL	General alarm
DO2	Return fan	DI6	Humidifier alarm	AL1	General alarm
DO3	Preheating pump 1	DI7	Return filter alarm	S1	Outside damper
DO4	Preheating pump 2	DI8	Supply fan thermal overload alarm		
DO5	Outside air damper	DI9	Return fan thermal overload alarm		
DO6	Bypass damper	DI10	Dirty heat recovery unit alarm		
DO7	Humidifier	DI11	Preheating pump 1 thermal overload alarm		
DO8	General alarm	DI12	Preheating pump 2 thermal overload alarm		
DO9	Reheating pump 1	DI13	Reheating pump 1 thermal overload alarm		
DO10	Reheating pump 2	DI14	Reheating pump 2 thermal overload alarm		



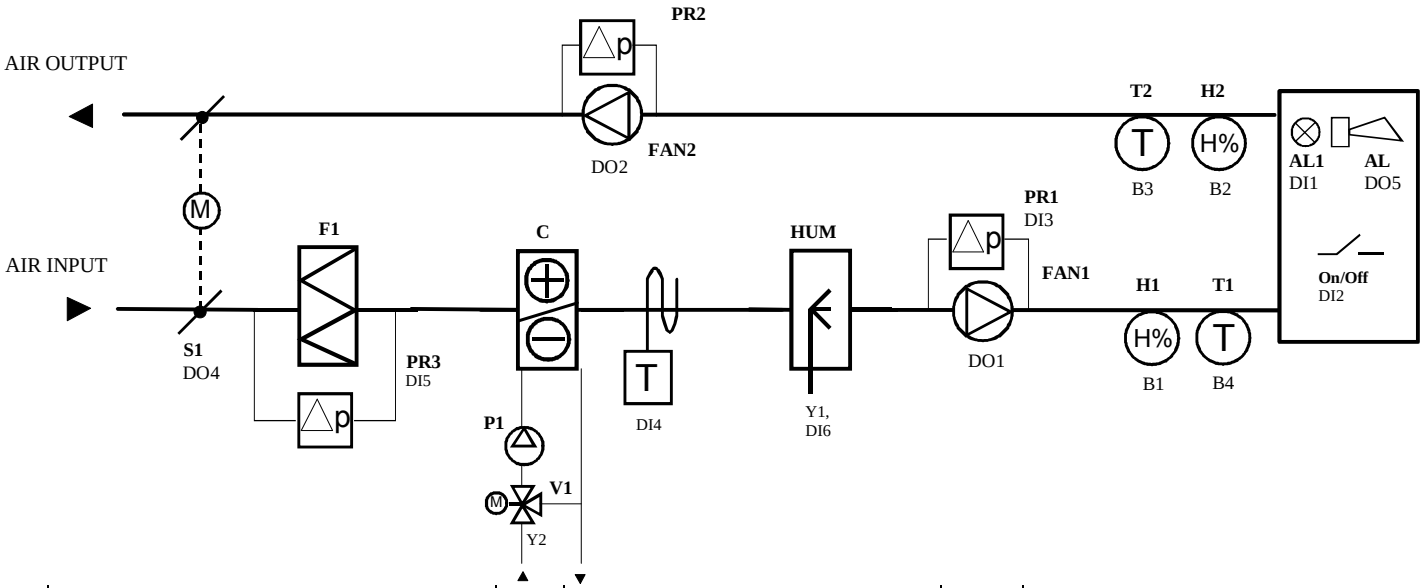
2.11.3 pCO3 Large



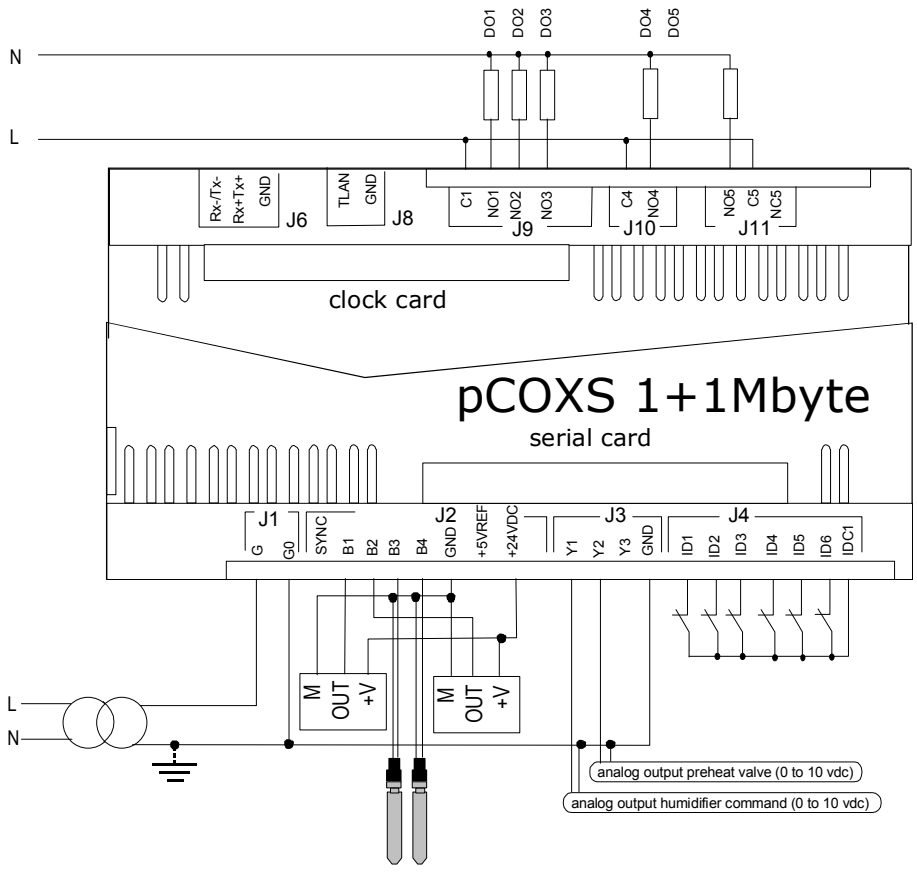
AI	Analogue inputs	AO	Analogue outputs	P1…4	Pumps
B1	Supply humidity	Y1	Humidifier	T	Temperature probe
B2	Outside humidity	Y2	Preheating valve	H	Humidity probe
B3	Return humidity	Y3	Cooling valve	C1	Preheating coil
B4	Supply temperature	Y4	Supply fan	C2	Cooling coil
B5	Return temperature	Y5	Outside/exhaust air damper	PR	Differential pressure switch/probe
B6	Differential pressure outlet air	Y6	Mixing damper	HUM	Humidifier
B7	CO2 probe	**DI**	**Digital inputs**	F1, F2	Filters
B8	Outside temperature	DI1	Generic alarm	AL	General alarm
B9	Frost protection temperature	DI2	Remote ON/OFF	AL1	General alarm
B10	Saturation temperature	DI3	Supply air flow alarm	S1	Outside/exhaust damper
DO	**Digital outputs**	DI4	Return air flow alarm	S2	Mixing damper
DO1	Supply fan	DI5	Supply air filter alarm	R	Heater
DO2	Return fan	DI6	Humidifier alarm		
DO3	Reheat heater 1	DI7	Return air filter alarm		
DO4	Reheat heater 2	DI8	Supply fan thermal overload alarm		
DO5	Reheat heater 3	DI9	Return fan thermal overload alarm		
DO6	Bypass damper	DI10	Reheating heater thermal overload alarm		
DO7	Humidifier	DI11	Supply fan inverter alarm		
DO8	General alarm	DI12	Return fan inverter alarm		
DO9	Preheating pump 1	DI13	Preheating pump 1 thermal overload alarm		
DO10	Preheating pump 2	DI14	Preheating pump 2 thermal overload alarm		
DO11	Cooling pump 1	DI15	Cooling pump 1 thermal overload alarm		
DO12	Cooling pump 2	DI16	Cooling pump 2 thermal overload alarm		
		DI17	Dirty heat recovery unit alarm		


N
L
service card
pCO3 Large
field card
serial card
analog output external air damper (0 to 10 vdc)
analog output mixing air damper (0 to 10 vdc)
analog output supply air fan (0 to 10 vdc)
analog output cooling valve (0 to 10 vdc)
analog output preheat valve (0 to 10 vdc)
analog output humidifier command (0 to 10 Vdc)

2.11.4 pCOXS 1+1Mbyte (pCO1XSE)



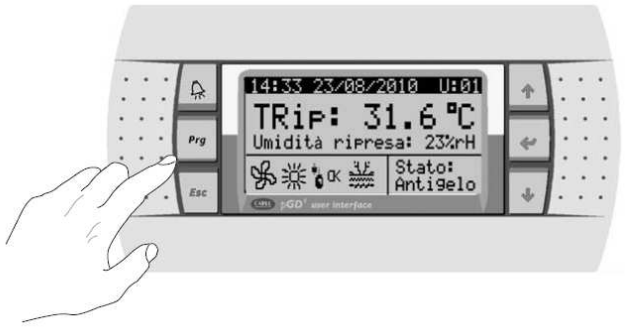
AI	Analogue inputs	AO	Analogue outputs	P1	Heating/cooling coil pump
B1	Supply humidity	Y1	Humidifier	T	Temperature probe
B2	Return humidity	Y2	Heating/cooling valve	H	Humidity probe
B3	Return temperature	**DO**	**Digital outputs**	C	Heating/cooling coil
B4	Supply temperature	DO1	Supply fan	PR	Pressure switch
DI	**Digital inputs**	DO2	Return fan	HUM	Humidifier
DI1	Generic alarm	DO3	-	F1	Filter
DI2	Remote ON/OFF	DO4	Outside/exhaust damper	AL	General alarm
DI3	Supply air flow alarm	DO5	General alarm	AL1	General alarm
DI4	Frost protection alarm			S1	Outside/exhaust air damper
DI5	Supply air filter alarm			FAN	Fan
DI6	Humidifier alarm				



3 USER INTERFACE

3.1 Graphic terminal

The pGD1 terminal, in the wall or panel-mounted versions, or included with the pCO board (built-in), features the display and the keypad, featuring 6 buttons that, pressed alone or in combination, are used to configure and program the controller.



BUTTON	DESCRIPTION
- Alarm	• Display the list of active alarms • Reset alarms with manual reset
Prg	Access the main menu
Esc	Return to previous screen
/ Up / Down	Scroll screen displayed or increase / decrease value
- Enter	• Switch from display to programming parameters • Confirm value and return to the list of parameters

3.2 Display and keypad

During normal operation, the graphic display shows the time, date and selected unit, two selectable system variables, the active device icon and unit control status.

Key	
1	Time/date/unit displayed
2	Variable 1 on display
3	Variable 2 on display
4	Active devices
5	Control status

Note:
• the graphic display can be shared across a pLAN network with a maximum of 8 pCO controllers. See screen F. Board switch;
• the variables on the display can be selected on screen Gfc01.

ICON	DESCRIPTION
	At least 1 fan on
OK	No preheating coil/ reheating/ cooling active
OK	Humidifier not active / no dehumidification
	Cooling coil active for cooling
	Cooling coil active for dehumidification
	At least 1 preheating or reheating coil active for heating or frost protection
	Humidifier active
	Frost prevention (see par. 8.16)
	Heat recovery unit active
FC FH	Freecooling or freeheating active

Note: if the unit is in freecooling or freeheating, the OK and OK icons are displayed next to the corresponding icon to indicate that no coil or humidifier is active.

CONTROL STATUS

	Text on display	Unit status
OFF	OFFbyALR	Off due to alarm
	OFFbyBMS	Off from BMS (*)
	OFFdaFSC	Off from time band
	OFFbyDIN	Off from digital input
	OFFbyKEY	Off from keypad
	Wait	Software checks in progress
ON	Unit ON	Unit on
	Manual	Manual actuator override (see Menu Gg)
	Comfort (Autocomfort)	Comfort mode (from time band)
	Pre-Comf (Autoprec)	Pre-comfort mode (from time band)
	Economy (Autoecon)	Economy mode (from time band)
	Protect	Protection mode
	Startup	Start-up phase
	Shutdown	Shutdown phase
	Purging	Purging phase
	Manual	Manually device override

(*) BMS = Building Management System

3.3 Programming mode

The parameters can be modified using the front keypad. Access differs according to the level: user parameters (accessible without password), Service (password=PW1) and Manufacturer (password = PW2). Press Prg to access the main menu.

MAIN MENU ICONS

A.	On/Off unit	E.	Data logger
B.	Setpoint	F.	Board switch
C.	Clock/scheduler	G.	Service
D.	Input/Output	H.	Manufacturer

Note: the control remembers the last category of parameters accessed and goes directly to this category when next accesses.

Set/display user parameters

The user parameters (A…F) are all the parameters accessible without password, and include the following categories:

A: ON/OFF Unit: set the ways the unit is switched ON and OFF;

B: Setpoint: display the current temperature and humidity set points (B01), set the temperature and humidity set point for cooling and heating modes;

C: Clock/scheduler: set the current time and date (C01), the daily time bands (C02) with weekly programming, holiday periods (C03), special days (C04), days when daylight saving starts and ends (C05);

D: Input/output: display the inputs and outputs, indicating the position of the terminals based on the markings screen printed on the pCO boards and the values measured by the probes (D01 to D29);

E: Data logger: display up to 50 alarms with progressive numbering, activation time and date, supply and return recorded;

F: Board switch: the terminal can be shared by up to 8 pCO controllers.

Browsing

1. press **Esc** one or more times to move to the standard display;
2. press **Prg** to enter the main menu tree;
3. select the category of parameters (A…H) with **Up / Down**;
4. press **Enter** to enter the first screen: the cursor flashes at the top left: press **Down** to move to the following screen (e.g. B01→ B02);

5. press **Enter** to set the first parameter on the screen: the cursor flashes in front of the value being set; press Up / Down to change the value and confirm by pressing **Enter**. This moves automatically to the next parameter.

6. press **Up/ Down** and **Enter** to set this parameter or **Enter** to move to the next parameter;
7. once having concluded the settings for the parameters on the screen, press **Enter** to access the screen, **Esc** to move to the higher level and continue settings parameters on other screens, following steps 3 to 7.

Note: modifiable text values are shown on the display in UPPER CASE.

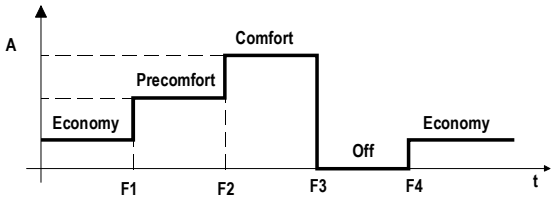
EXAMPLE 1: Setting the current time/date.

1. press Esc one or more times to move to the standard display;
2. press Prg: the display shows the main menu;
3. Press UP/DOWN to move to category C. Clock/scheduler;
4. press Enter to display the first screen: C01;
5. Press Enter to modify the current time using UP/DOWN;
6. Confirm by pressing Enter and move to the minutes;
7. repeat steps 5 and 6 three times to modify the date (day / month / year);
8. press Esc to exit the parameter setting procedure.

Note: the clock must be enabled on screen Hc20 if the clock card is installed on the pCO^{XS}.

EXAMPLE 2: Setting the time bands.

1. press Esc one or more times to move to the standard display;
2. press Prg: the display shows the main menu;
3. Press UP/DOWN to move to category C. Clock/scheduler;
4. press Enter and UP/DOWN to display the second screen C02: "Enable bands" and choose "YES";
5. choose the day of the week, the time each band **starts** (F1, F2, F3, F4) and the corresponding operating mode;
6. if necessary copy the settings from one day to another.



Note: the set point for Comfort, Precomfort and Economy modes can be set on screens B02, B03, B04 respectively.

Setting the Service parameters

The Service parameters (letter G) concern:
1) parameters modifiable without password:
a: Change language;
b: Information: application, BIOS and BOOT version;
c: Summer/winter: summer/winter changeover mode (keypad, digital input, BMS, auto, water temperature);
d: Working hours: read device operating hours;
2) parameters accessible with **password PW1 (default =1234);**
e: BMS configuration: choose the BMS communication protocol (CAREL, LON, Modbus), communication speed (baud rate), network address and activate commissioning service (Ge03);
f: Service settings: include device operating hour settings, probe calibration, temperature control and change password (PW1);
g: Manual management: procedure for manually activating the devices so as to prepare for commissioning.

Procedure:
The setting/display procedure is similar to the one for the user parameters, however password PW1 must be entered to access category G parameters.

Note:
• if no button is pressed, after around 5 min the display automatically returns to standard mode;
• the service password PW1 can be changed on screen Gfd03;
• once entered, the password remains active for a certain time, after which it needs to be entered again.

Setting the Manufacturer parameters

The Manufacturer parameters (letter H) are only accessible after entering **password PW2 (default =1234)**, and concern:
a. Selection and configuration of the devices on the AHU;
b. I/O configuration: configuration of inputs and outputs, in other words assignment of the position of the probes (e.g. supply, return, room temperature), digital inputs (e.g. remote ON/OFF, summer/winter changeover, alarms), digital outputs (e.g. fans, pumps, heaters) and analogue outputs (e.g. fans, dampers, humidifier);
c. Factory settings: setting of temperature and humidity control probes, minimum and maximum limits for opening the dampers, fan activation delay, coil activation delay on unit startup, travel times of three position valves, temperature limits for activation of preheating, reheating and cooling coils, delay time for activation of alarms and inverter (VFD) configuration parameters for the supply and return fan. See the chapters on commissioning and description of the functions.

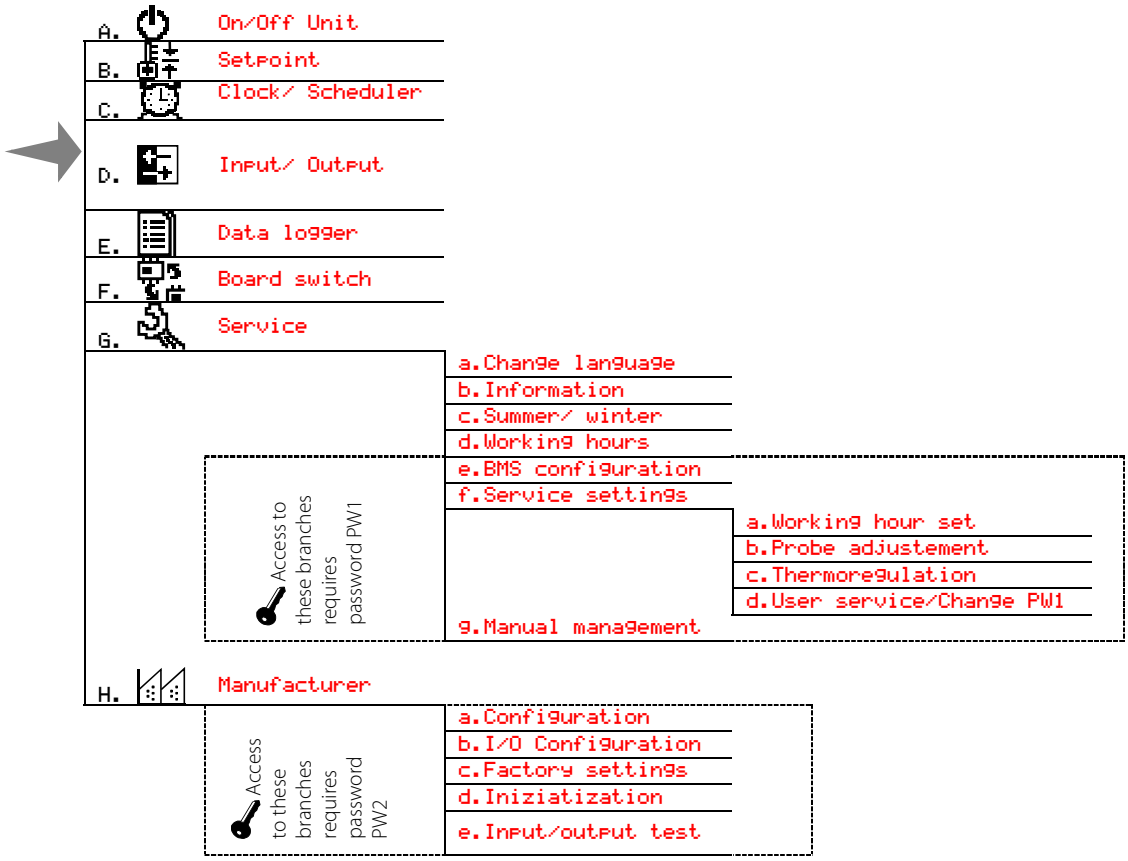
Procedure:
The setting/display procedure is similar to the one for the user parameters, however password PW2 must be entered to access category H parameters.

Important: the Manufacturer parameters can only be modified when the controller is OFF.

Note:
• the manufacturer password PW2 can be changed on screen Hd03;
• entering the manufacturer password PW2 also allows access to the parameters protected by service password PW1.

4 DESCRIPTION OF THE MENU

Press the Prg button to access the main menu. Select the category of parameters using UP/ DOWN and confirm by pressing Enter. If the password is required, enter each figure using the Up/Down buttons and confirm by pressing Enter. After a certain time, if no button is pressed, the password will need to be entered again.



4.1 A. On/Off Unit

There are two possible cases:

• if time bands are disabled (C.Clock/scheduler → C02.Enable scheduler), the unit can only be switched on from the keypad in Comfort mode. The temperature and humidity set points defined for this mode will then be used indefinitely for control. (B.Setpoint → B02.Comfort);

• if time bands are enabled, the unit will be able to follow the time band settings if "Auto" is selected (A.On/Off Unit → A01.Auto). On the display, in the special area, the operating mode will be determined by the time band setting (C02) and preceded by the prefix "Auto". If a different operating mode is selected, the unit switches to manual mode.

Note: see the "Functions" chapter for the complete description of the On/Off function.

4.1.1 Manual mode

If time bands are enabled (C.Clock/scheduler → C02.Enable scheduler), and the unit is started from the keypad (A01.On/Off Unit), the following operating modes can be selected:

1. Auto: see previous paragraph;
2. Manual mode: the unit is forced to operate in one of the available operating modes (OFF, Economy, Pre-comfort, Comfort), for a time ranging from 30 minutes to 8 hours. Automatic operation can resume after this period by enabling reset (A.On/Off Unit → Enable auto-resume). Naturally the temperature and humidity set points must have previously been set in the corresponding menu (B02.Setpoint→Comfort; B03.Setpoint → Pre-comfort; B04.Setpoint→Economy). The display shows the operating mode in the relevant area, e.g. Comfort.

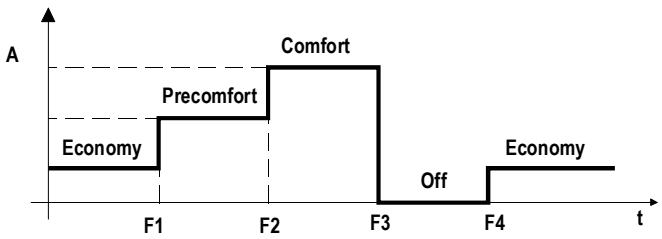
4.2 B. Setpoint

The first screen B01 displays the current temperature and humidity set points. The temperature set point displayed considers any set point compensation function operating (see the "Functions" chapter). If time bands are enabled (C: Clock/scheduler → C02: Enable scheduler), different temperature and humidity set points can be set for Economy, Pre-comfort and Comfort modes (B: Setpoint → Comfort, Pre-comf, Economy) according to the season, summer or winter. In total, then, 6 temperature set points and 6 humidity set points can be set (screens B02, B03, B04). If time bands are not enabled, only the set point for comfort mode can be set. Economy mode is used to set a reduced set point (e.g. night-time), for lower energy consumption, and the unit can be switched from Comfort to Economy mode via a digital input, if enabled (screen Ha18); Pre-comfort mode is half-way between Economy and Comfort.

4.3 C. Clock/Scheduler

The following values can be set:
• current time and date;

• enable and program the time bands. The time bands are programmed on a weekly basis, with four time bands available for each day of the week, starting from times F1, F2, F3, F4. Each time band can be assigned an operating mode, choosing between OFF, Economy, Pre-Comfort and Comfort. The settings can be copied from one day to another;



Key:

F1 to F4	Start time band 1 to 4	t	time
A	Operating mode		

Note: the set points can be set independently for each operating modes;
• holidays: three holiday periods can be set, with start and end sate and operating mode (Economy, Pre-comfort, Comfort).

• special days: up to six special days can be selected, defining the operating mode;

Note: the "auto" option involves normal operation based on the time band settings.

• enable daylight saving, selecting the start and end date and time for the period. A transition time can be set, between 0 and 240 minutes.

Note: if set point from digital input is enabled (screens Ha18 and Hb24: double set point), the input can be used to switch from Comfort to Economy mode. In that case, screens C02, C03, C04 are not shown when programming the time bands, holidays and special days.

4.4 D. Input/Output

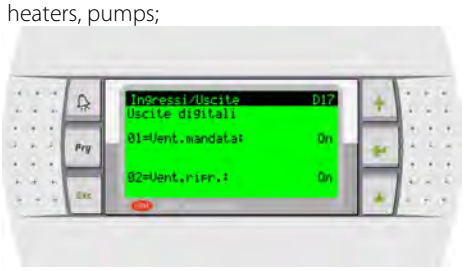
Note: after configuring the software (see the corresponding chapter) menu D is used to see what inputs and outputs have been configured.

The first row on the screens in menu D indicates the type, input or output, analogue or digital, to make browsing simpler.

1	Type of input	3	Description of the input
2	Terminal number on board	4	Value measured

• analogue inputs: temperature, humidity, differential pressure and air quality probes.
• digital inputs: status of pressure switches/flow switches connected to the supply and return filters (open/closed), flow switches connected to supply and return air fans, safety thermostats for pumps/fans, heaters, alarms on the inverter connected to the supply/return air fan, dirty heat recovery unit alarm, remote On/Off controls, change season summer/winter;

• display % air quality request and purge request;
• digital outputs: activate/deactivate the supply/return air fan, defrost heater, heat recovery unit, humidifier, general alarm, bypass damper, reheating heaters, pumps;



Note: the status of the digital input (ON/OFF) also depends on whether its configured as normally open (NO) or normally closed (NC) in menu Hb.

• analogue outputs: control signals for modulating actuators, supply/return air fan, dampers, humidifier, valves. See the list of parameters.

Important: the menu D only shows the inputs/outputs that have been enabled, i.e. position ≠ 0 assigned in menu Hb. See paragraph 6.3.

4.5 E. Data logger

From the main menu (E.) the logged alarms can be displayed in sequence: the alarm is saved with its number in the log, the time, date, code, description and the supply (TS) and return (TR) temperature measured when the alarm was activated; to cancel the alarms, access the Service menu with password (G.Service →f.Service settings→d.User service/Change PW1 → Delete data logger). The "Alarm" button, on the other hand, is used to mute the buzzer (if fitted), display currently active alarms and reset them (obviously these remain in the log) and at the end of the list go directly to the data logger.

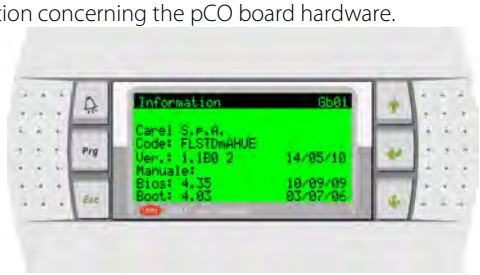
Note:
• also see the chapter on alarms;
• the alarm log cannot be accessed directly by pressing the alarm button

4.6 F. Board switch

The main menu (F.) displays the graph of controllers connected in the pLAN network. To switch from one controller to another, scroll to the "go to unit" field and enter the address of the unit to connect to: as soon as the connection has been established, the address is shown in the "unit address" field and on the graph.

4.7 G. Service

The main menu (G.) provides access to a submenu divided into two parts: the first (a,b,c,d) is not password-protected and can be used to display and set the following:
G.a. Change language: select one of the languages loaded in the application program (Italian, English…) and then on the following screen enable language selection when starting;
G.b. Information: information relating to the application code (and version), on the first screen available, while the second shows the information concerning the pCO board hardware.



G.c. Summer/Winter: the season can be selected via:
• Keypad: the following screen is used to select the current season: summer or winter;
• Digital input: summer/winter changeover depends on a previously configured digital input (Hb24);
• BMS: season changeover is managed by the supervisor;
• Keypad/BMS: the season changeover control is the most recent between keypad or BMS;
• AUTO: if "FIX DAYS" is selected on the following screen, the start summer and start winter dates can be set, while if on the other hand AUTO is selected, as well as the start summer and start winter dates temperature thresholds can be set to change season automatically. See paragraph 8.7;
G.d. Working hours: displays the operating hours of the main devices on the AHU (fans, humidifier, pumps, heaters) that may require periodical maintenance.

Note: from this point on in the submenu, password PW1 must be entered to browse the screens.

G.e. BMS configuration: this section is used to set all the parameters required for connection to a supervisory system, such as the protocol, communication speed and address. The BMS offline alarm can be enabled to signal communication failures during operation, and finally the commissioning service can be activated, requiring connection to a computer running the pCO manager program.

G.f.a. Working hour set: used to set the operating hour threshold for the main devices on the unit: fans, humidifier, pumps and heaters. When the operating hours are exceeded a "warning" is shown that must be reset by accessing this screen. See the chapter on alarms.

G.f.b. Probe adjustment: used to set an offset to add too or subtract from the probe reading in question (temperature, humidity, differential pressure, air quality). Once having confirmed the offset value (Cal), pressing ↵ automatically updates the value of the corresponding probe (shown to the side).
G.f.c. Thermoregulation: this branch includes all the parameters relating to temperature control and that can be modified during installation or service, except for the manufacturer parameters, which are located in branch H.c;
• Main mask information: these are the two variables available on the standard display;
• Temperature/humidity limits set: these are the minimum and maximum limits for setting the corresponding set points (B.Setpoint → B02.Comfort, B03.Pre-comfort, B04.Economy) in Economy, Pre-comfort and Comfort modes, both summer and winter;
• For the explanation of the following screens relating to the control algorithms, see the "Functions" chapter.
G.f.d. User service/change PW1: this is used to:
• load the unit configuration saved (H.Manufacturer → d.Initialization → 01.Save configuration) at the end of the software configuration procedure (see chapter 6);
• delete the alarm log;
• change the Service password (PW1);
G.g. Manual management: is used to switch the individual devices on the unit from automatic to manual. For the digital outputs the options are ON (100%) or OFF (0%), while for analogue outputs the possibilities vary from 0 to 100%. This selection bypasses control, but not the alarm thresholds, so as to safeguard unit safety; in general, this operation is used to test the individual actuators during commissioning (see chapter 7).

Note: if a device is managed manually, the control status on the display is "manual".

4.8 H. Manufacturer

The main menu (H.) provides access to the manufacturer submenu, after entering the corresponding password PW2.

4.8.1 Ha: Configuration

The configuration is the first step in defining the type of air handling unit. Unlike other software that allows selection of a preloaded model that comes closest to the actual one, then making any slight changes required, this application program uses the following identification procedure:
1. hard copy drawing of the air handling unit;
2. choice of the type of actuators installed on the unit in the configuration menu.

Note: below is a brief description of the menu: the detailed software configuration procedure is described in chap. 6.

Ha01:
• fan type: supply fan only or supply and return air fans; in the latter case an activation delay can be set for the return fan after the supply fan (Hc06);
• coil type: none, cool+pre+reheat, cool, heat, cool + preheat; cool + reheat, heating/cooling, heating/cooling + reheat;
• enable humidifier and heat recovery unit;

Note: if the heating/cooling is used, enable the heat / cool output on Hb42 for changeover based on demand and the switching delay set on Hc12;

Ha02:
• damper type: fresh air only (On/Off or modulating), fresh air+mixing, fresh air+mixing+exhaust, fresh air (modulating) +exhaust;
• enable freecooling and freeheating by temperature or enthalpy;
• enable air quality control;

Ha03:
• select the type of fan control: see paragraph 8.14;
Ha04: type of fan alarms: see paragraph 8.14;
Ha05: select preheating device:
• modulating valve: control with 0 to 10 Vdc input: once selected, a minimum value > 0 V and a maximum value <10 V can be set;
• floating valve: the floating valve motor travel time needs to be defined (Hc08): 1 to 3200 s;
• heaters: see paragraph 8.13;
• select probe used for humidification: paragraph 8.4;

Ha06: select cooling device:
• modulating valve;
• floating valve: the floating valve motor travel time needs to be defined (Hc08): 1 to 3200 s;
• direct expansion: from 1 to 3 steps can be selected. The demand managed by the steps is divided into equal parts based on the number of steps selected. On the cooling cascade screen (Gfc20) set the % of demand managed by freecooling (if enabled) and the remaining % managed by the cooling coil;
• type of dehumidification: see paragraph 8.4.

Ha07: type of heating/cooling coil:
• modulating valve;
• floating valve;
• steps: similar to direct expansion described for Ha06.
Ha08:
• select reheating device: see the selection of the preheating device;
• select function of reheating coil:
1) compensation: this involves heating the air after having dehumidified it using the cooling (reheating) coil or after having humidified the air using the adiabatic humidifier;
2) integration: in heating cascade control, the reheating coil supplements the preheating coil. The action of the reheating coil and the preheating coil may overlap (Gfc22);
3) compensation +integration: both functions are performed.
Ha09: enable coil pumps and water flow control alarms.
See paragraph 8.12;
Ha10/Ha11/Ha12: cooling / preheating / reheating coil pumps. See paragraph 8.12;
Ha13: type of humidifier: see paragraph 8.4.

Ha14: enable and select type of heat recovery unit: see paragraph 8.10.

Note: assign the analogue/digital outputs to the actuators in the I/O configuration menu. Also set the maximum and minimum values for the modulating bypass damper.

Ha15: air quality and enable purging.
See paragraph 8.15.

Ha16: frost protection. See paragraph 8.17.
Ha17: ON/OFF from digital input and BMS. See paragraph 8.1.
Ha18: setpoint from digital input. See paragraph 8.1.
Ha19: setpoint offset by analogue input. See paragraph 8.2.
Ha20, Ha21, Ha22, Ha23: auxiliary regulation loops. See paragraph 8.18.
Ha24: Protocols
Protocols can be set:
a) for the BMS serial:
• Winload: the Winload protocol must be selected in order to activate the Commissioning service, i.e. for setting the parameters from pCO Manager. The RS485/USB converter code CVSTDUMOR0 and RS485 serial interface (PCOS004850) are required;
• BMS: select between the boards listed in chapter 1.

b) for the Fbus serial:
• Belimo: see paragraph 6.8.
• Modbus master: connect the optically-isolated RS485 card (code PCO100FD10).

Ha25: Modbus master settings
Set the parameters for the Modbus master protocol:
• Baudrate or transmission speed: 1200/2400/4800/9600/19200 bit/s;
• Stop bits: 1 or 2;
• Parity: even or no;
• Timeout: 100 to 5000 ms: this is the time after which if communication is interrupted the device offline error is shown: serial probe or VFD (Variable Frequency Drive = inverter).

Ha26: Modbus master settings
Number of pCOe expansion cards and serial probes.

Ha30: enable probes and digital inputs from supervisor
See paragraph 6.9.

Ha39… Ha56: screens relating to the VFD Carel inverter
See the Commissioning chapter.

4.8.2 Hb: I/O configuration
See paragraph 6.3.

4.8.3 Hc: Factory settings
See the "Software configuration" and "Functions" chapters.

5 SOFTWARE INSTALLATION

The following systems can be used to update and install the FLSTDMAHUE application on the pCO controller board:
• pCO Manager (with Winload communication protocol);
• SmartKey.

5.1 pCO Manager

On all CAREL 16 bit pCO sistema controllers (see the pCO sistema manual) the resident software can be updated using a PC. For this purpose, CAREL provides the pCOLoad program and a serial converter with RS485 output (code CVSTDUTLF0) to be connected to the pCO. The special driver also needs to be installed on the PC, also provided by CAREL. The program is included in the installation of the "1Tool" program suite or with the pCO Manager program, downloadable separately from http://ksa.CAREL.com, under "download support software utilities". The installation, as well as the program, also includes the user manual. The pCO controller can be connected directly to the PC via the RS485 serial port used for the "pLAN" connection or using the BMS serial port with optional RS485 serial card used for the "supervisor" connection.

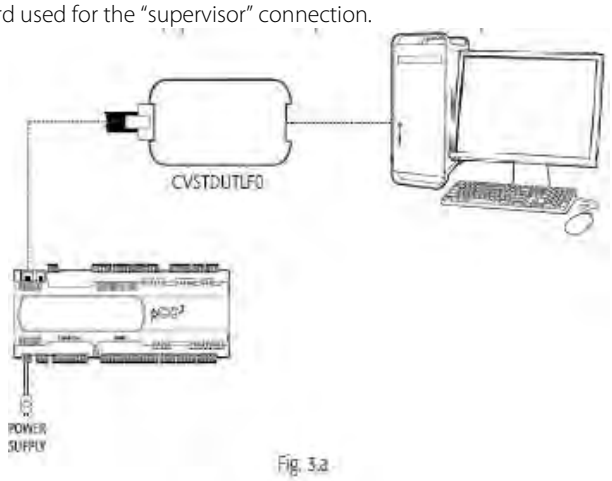


Fig. 3.a

It must be underlined that updating the BOOT Updating the BOOT is generally NOT RECOMMENDED by CAREL; during production CAREL always loads the BOOT required for the correct operation of the unit. Only in very special cases will CAREL ask the user to update the BOOT. The BIOS can only be loaded via the pLAN serial connection.
When updating the application and the BIOS, the pCO operating mode switches to low level. In this special mode, the logged data cannot be downloaded to the PC nor can the application be loaded in compressed format. To return the unit to normal communication mode, reset the pCO board. If uploading the BOOT or BIOS files only, the other application files then need to be uploaded again. The consequences of interruption to the upload procedure depend on the instant this occurs. In any case, the upload needs to be repeated. If pCOLoad cannot connect to the pCO, a Smart Key must be used to download the BIOS and any other operating application (e.g.: pCO functional test). This refreshes the pCO memory, allowing connection to pCOLoad.

Commissioning Tool (1tool)
Commissioning tool is configuration and real-time monitoring software used to check the operation of an application installed on a pCO, for commissioning, debugging and maintenance. This tool can be used to set the configuration parameters, set the values of volatile and permanent variables, save the trend in the main values of the unit to a file, manually manage the unit I/Os using a simulation file and monitor/restore the alarms on the unit where the device is installed.
The configuration functions available on the commissioning tool allow the designer to decide which variables will be monitored/logged/plotted or monitored by event, to organise the variables into categories, and to choose the set of configuration parameters.

Support files
Following development of the application, 1tool generates various files during compilation; these include two that are required for commissioning:
< applicationName>.2CF (descriptive of variables)
<applicationName>.2CD (descriptive of categories and access profiles)
As well as these files, the <applicationName>.DEV file that contains the pre-defined set of unit parameters can also be managed. When the commissioning procedure is complete, or for configuration or monitoring, the user can generate the following files:
<applicationName>.2CW (descriptive of categories, access profiles, monitoring groups)
<CommissioningLogFileName>.CSV (commissioning log file, containing the data on the variables recorded during monitoring);
For the configuration phase of the commissioning procedure, the following files must be available: .2CF, 2CD and where necessary .DEV, which can be imported and exported.
For the monitoring phase, as well as the files mentioned above, the .2CW file with the definition of the working environment may be required. The commissioning log file is an output file only.

Connection modes
Each controller has three serial ports (0, 1 and 2), each with its own default protocol:

Port	Default protocol	Description
Serial 0	pLAN	Connection to terminal and pLAN network
Serial 1	BMS	Supervisor connection
Serial 2	FieldBus	Field device connection

There are two modes for commencing local communication between pCO Manager and the controller:
1) Activate the WinLoad protocol on the required port;
2) On BMS and FieldBus only, irrespective of the protocol set on the pCO, simply connect pCO Manager and from "Connection settings" select SearchDevice = Auto (BMS or FB). In this case it will take around 15-20 seconds to go online.

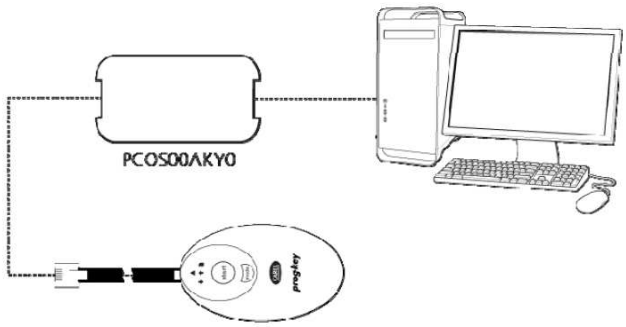
Memory limits
The periodical monitoring of the application variables is limited to a maximum of 250 WORDS, freely selectable from the entire memory available to the application. The virtualisation of application variables is limited to a maximum of 50 WORDS, selectable from the entire memory available to the application. There are no address limits for "one-shot" read/write of individual variables: all memory addresses reserved for the application in all types of memory available on the pCO can be used: X memory, T memory, P memory, E memory.

Note: for further details on installing and updating the software on the pCO controller, see the online help for the pCO Manager program.

5.2 SmartKey

The SMARTKEY programming key is used to emulate the operation of the parallel programming key on pCO models where this is not available (pCOXS, pCO3), with the exception of the BOOT, which is not loaded by the SMARTKEY. Specifically, the key can clone the contents of one pCO and then download the data to another identical pCO via the terminal telephone connector (the pLAN must be disconnected). This function is obviously available for all pCO controllers, even those with parallel key. In addition to this mode, the key can transfer the data logged on a series of pCO devices and

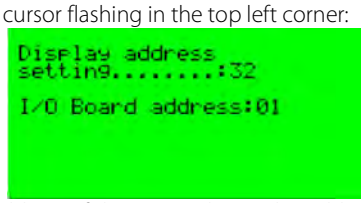
download them to the PC. From the PC, using the "SMARTKEY PROGRAMMER", the key can be configured to run certain operations: retrieve logs, program applications, program BIOS, etc. For further details see the online help for the "SMARTKEY PROGRAMMER" and the SMARTKEY instruction sheet.



Note: for further details on installing and updating the software on the pCO controller, see the online help for the pCO Manager program.

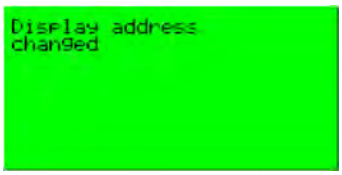
5.3 Setting the terminal address

The address of the terminal can be set in the range from 0 to 32; addresses between 1 and 32 are used by the pLAN protocol, while address 0 identifies the Local terminal protocol, used for non-graphic point-to-point connections and to configure the pCO controller. The default address is 32. The address of the terminal can only be set after having powered the terminal via the RJ12 connector. To access configuration mode press ↑, ↓, and ↵ together for at least 5 seconds; the terminal will display a screen similar to the one shown below, with the cursor flashing in the top left corner:



To modify the address of the terminal ("Display address setting") carry out the following operations in sequence.

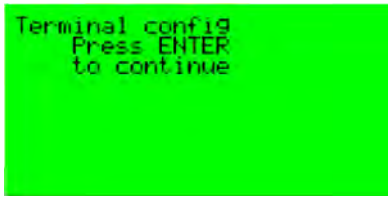
1. Press ↵ once: the cursor will move to the "Display address setting" field;
2. Select the desired value using ↑ and ↓, and confirm by pressing ↵ again;
3. If the value selected is different from the value saved, the following screen will be displayed and the new value will be saved to the permanent memory on the display.



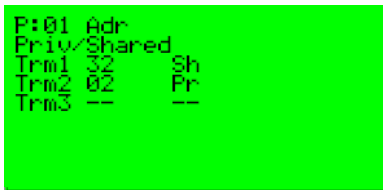
If the address field is set to 0, the terminal communicates with the pCO board using the Local terminal protocol and the "I/O Board address" field disappears, as it no longer has any meaning. To modify the list of the terminals (private and shared) associated with a pCO board, carry out the following operations in sequence:

4. Enter configuration mode (see above) pressing ↑, ↓and ↵ together for at least 5 seconds.
5. Press ↵ twice: the cursor will move to the "I/O Board address" field.
6. Select the address of the pCO board in question and confirm by pressing ↵.

Then the pCO controller will start the configuration procedure, opening a screen similar to the following.

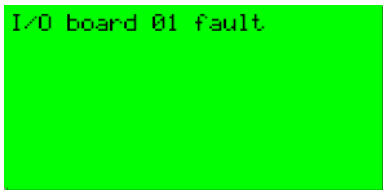


7. Press ↵ again: the configuration screen will be shown, similar to the one below.



8. Configure the terminals as desired. Pressing ↵ moves the cursor from one field to the next, while ↑and ↓ change the value of the current field. P:xx represents the address of the selected pCO board (in the example in the figure, this is board 1).
9. To exit the configuration procedure and save the data, select "Ok?", set "Yes" and confirm by pressing ↵. During the configuration procedure, if the terminal remains inactive (no button is pressed) for more than 30 seconds, the pCO board automatically interrupts the procedure without saving any changes.

Important: if during operation the terminal detects inactivity on the pCO board it is connected to, the display is cancelled and a message similar to the one shown below is displayed.

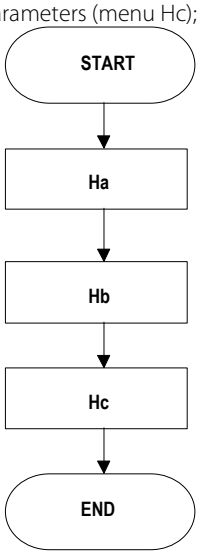


If the terminal detects inactivity of the entire pLAN network, that is, it does not receive any messages from the network for 10 seconds consecutively, the display is cancelled completely and the following message is shown:

6 SOFTWARE CONFIGURATION

Important: some of the following operations are often carried out during installation, as the devices are connected in the field and configured.

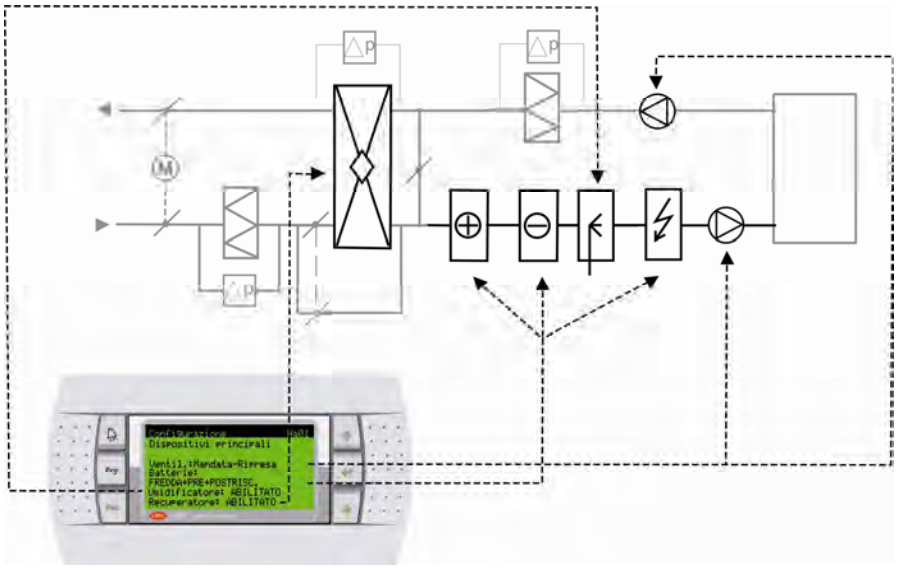
The software configuration procedure includes these steps:
1) Select devices (screens Ha01, Ha02);
2) Configure devices (screens Ha03, …, Ha30);
3) Assign inputs/ outputs (menu Hb);
4) Set device control parameters (menu Hc);



6.1 Select devices (Ha)

Once the application program has been installed and the electrical connections have been completed (see the "Hardware installation" chapter), the operations required for commissioning the controller depend on the type of air handling unit, and involve these steps:
1) Check correspondence between the design AHU - it's **recommended to refer to a complete hard copy drawing** - and the AHU managed by the pCO board with the default parameters. See the "Hardware installation" chapter;
2) If the design AHU is similar to the default AHU, try adding or removing devices or probes until achieving a complete match;
3) If the design AHU is very different from the unit managed by the default parameters, delete all the configured analogue and digital inputs and outputs. To do this access menu H. Manufacturer →b.I/O configuration → Hb99. Positions deletes to delete the default configuration and then enter the new configuration;
4) Access menu H. Manufacturer →a.Configuration to select:
• Ha01: the main devices on the AHU (number of fans, number of heating coils, enable humidifier, enable heat recovery unit;
• Ha02: type of dampers, enable freecooling/freeheating (by temperature/ enthalpy), air quality control…
5) Again in menu H. Manufacturer →a.Configuration: configure the type of devices: modulating valve, floating valve, heaters, no. of pumps for each coil, type of air quality control and other functions such as purging, type of frost protection, etc. See the table of parameters for the list of devices on the "Ha" screens that are displayed according to the selections made on Ha01 and Ha02.

EXAMPLE: the default configuration of the pCO Large includes a heat recovery unit with bypass damper. If the AHU is designed for an application in which neither freecooling nor the possibility of frost forming on the heat recovery unit are envisaged, this device may not exists and therefore can be excluded, thus freeing an output. Simply access the "Configuration" menu (screen Ha14) and disable the bypass damper.



Note: selecting the devices on screens Ha01 and Ha02 defines the AHU and determines which of the following screens or configuration menus for the inputs and outputs (Hb) are displayed

6.2 Configure devices (Ha)

From screen Ha03 on the selected devices, type of control and corresponding probes are configured. These settings must be coherent both with the electrical connections made and the software loaded on the pCO board during installation.
Ha03) fan type: with inverter or on/off control, see paragraph 8.14;
Ha04) fan alarms: thermal overload and/or flow;
Ha05) preheating device: floating valve, modulating valve, heaters;
Ha06) cooling device: floating valve, modulating valve, floating valve, direct expansion steps;
Ha07) heat/cool coil;
Ha08) reheating device: floating valve, modulating valve, heaters;
Ha08) reheating operation for compensation, integration, integration + compensation;
Ha09): enable pumps on cooling, preheat and reheating coils;
Ha13): type of humidifier: isothermal or adiabatic, ON/OFF or modulating;
Ha14): type of heat recovery unit: cross-flow, run-around coil or modulating heat wheel;
Ha14): bypass damper fitted;
Ha15): air quality control type: P+I or proportional only;
Ha15): air quality probe type: CO_2, VOC, CO_2+VOC;
Ha15): enable purging;
Ha16): frost protection type: from probe, thermostat, probe+thermostat;
Ha17): enable unit ON/OFF from digital input or BMS;
Ha18): enable change set point from comfort to economy from digital input;
Ha19): enable offset on setpoint from analogue input;
Ha19): activate auxiliary control loop;
Ha24): select protocol on Fieldbus serial and BMS serial;
Ha25): communication speed, parity and timeout for Modbus master protocol;
Ha26): number of pCOe expansion cards and number of serial probes connected;
Ha29): configure VFD inverter parameters;
Ha30): enable probes and digital inputs from supervisor.

6.3 Assign inputs/outputs (Hb)

In the menu H. Manufacturer →b.I/O configuration:
1) select the type and position of the analogue and digital inputs and the analogue and digital outputs. For active probes also set the minimum limit attributed to the minimum input value and the maximum limit attributed to the maximum input value;
2) Check the configuration in menu D. Inputs/outputs and the input readings;
3) Test the outputs (He01…) to verify correct wiring and operation of the devices.

Note:
• the controller automatically identifies which terminals are free and automatically proposes the first available positions, according to the type of input (e.g. NTC, PT1000, 0 to 1 V, 0 to 10 V, 4 to 20 mA) based on the hardware features of the pCO board used;
• some screens are only shown if the corresponding device has been enabled and configured;

Important:
• a device is only enabled if the position of the corresponding analogue or digital output is not zero;
• a probe or digital input is only enabled if the position of the corresponding input ≠0, or is selected from the serial probes (T1…T6, H1…H6, A1…A6), probes on the pCOe expansion card (E1…E8) or supervisor probes (S1…S4). See paragraphs 6.5 and 6.6;
• if certain inputs or outputs are not shown on the assignment screens as expected, see the parameters table, which highlights the conditions required for displaying a screen.

CONFIGURABLE INPUTS

ANALOGUE		DIGITAL	
Ref.	**Description**	**Ref.**	**Description**
Hb01	Supply temperature	Hb24	Remote On/Off
Hb02	Return temperature	Hb24	Summer/winter
Hb03	Outside temperature	Hb24	Set point from DI
Hb04	Room temperature	Hb25	Generic alarm
Hb05	Supply humidity	Hb25	Serious alarm
Hb06	Return humidity	Hb25	Frost protection alarm
Hb07	Outside humidity	Hb26	Supply filter 1 alarm
Hb08	Room humidity	Hb26	Supply filter 2 alarm
Hb09	Supply diff. pressure	Hb26	Return filter alarm
Hb10	Return diff. pressure	Hb27	Supply flow switch
Hb11	Frost protection temperature	Hb27	Return flow switch
Hb12	Saturation temperature	Hb28	Humidifier alarm
Hb13	CO2 probe	Hb28	Supply inverter alarm
Hb14	VOC probe	Hb28	Return inverter alarm
Hb15	Exhaust temperature	Hb29	Supply fan 1 thermal overload
Hb16	Cooling or heating/cooling coil temperature	Hb29	Supply fan 2 thermal overload
Hb17	Preheating coil temperature	Hb29	Return fan 1 thermal overload
Hb18	Reheating coil temperature	Hb29	Return fan 2 thermal overload
Hb19	Auxiliary probe 1	Hb30	Cooling pump 1 thermal overload
Hb20	Auxiliary probe 2	Hb30	Preheat pump 1 thermal overload
Hb21	Auxiliary probe 3	Hb30	Reheat pump 1 thermal overload
Hb22	Auxiliary probe 4	Hb31	Cooling pump 2 thermal overload
Hb23	Set point offset from AIN	Hb31	Preheat pump 2 thermal overload
		Hb31	Reheat pump 2 thermal overload
		Hb32	Cooling pump flow switch
		Hb32	Preheat pump flow switch
		Hb32	Reheat pump flow switch
		Hb33	Dirty heat recovery unit alarm
		Hb33	Preheat heater overload
		Hb33	Reheat heater overload
		Hb34	Dirty filter alarm
		Hb34	Door contact open
		Hb34	Smoke-fire alarm

POSSIBLE OPTIONS		POSSIBLE OPTIONS	
pCO^{XS} 1+1Mbyte	1 to 4	pCO^{XS} 1+1Mbyte	1 to 6
pCO^{3}SMALL	1 to 5	pCO^{3}SMALL	1 to 8
pCO^{3}MEDIUM	1 to 8	pCO^{3}MEDIUM	1 to 12
pCO^{3}LARGE	1 to 10	pCO^{3}LARGE	1 to 14
pCOe (not PT1000)	pCOe1: E1 to E4	pCOe	pCOe1: E1 to E4
	pCOe2: E5 to E8		pCOe1: E5 to E8
Serial probes	Temperature: T1 to T6; A1 to A6	Belimo®	M1 to M8
	Humidity: H1 to H6; A1 to A6	BMS variables	S1 to S4
Belimo®	M1 to M8		
BMS variables	S1 to S4		

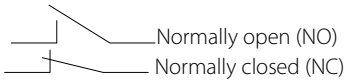
CONFIGURABLE OUTPUTS

ANALOGUE		DIGITAL	
Ref.	**Description**	**Ref.**	**Description**
Hb51	Supply fan	Hb35	Supply fan 1
Hb52	Return fan	Hb35	Return fan 1
Hb53	Outside damper	Hb35	Humidifier
Hb54	Mixing damper	Hb36	Supply fan 2
Hb55	Exhaust damper	Hb36	Return fan 2
Hb56	Bypass damper	Hb37	Supply fan star delta
Hb57	Humidifier	Hb38	Return fan star delta
Hb58	Preheating valve	Hb39	Bypass damper
Hb59	Cooling valve or heating/cooling	Hb39	Heat wheel/heat recovery unit pump
Hb60	Modulating preheating heater	Hb40	General alarm
Hb61	Reheating valve	Hb40	Serious alarm
Hb62	Modulating reheating heater	Hb40	Minor alarm
Hb63	Heat wheel	Hb41	Unit status (ON/OFF)
Hb64	Auxiliary 1	Hb41	Filter alarm
Hb65	Auxiliary 2	Hb41	Heat recovery unit defrost heater
Hb66	Auxiliary 3	Hb42	Heat/cool
Hb67	Auxiliary 4	Hb43	Cooling pump 1
		Hb43	Preheat pump 1
		Hb43	Reheat pump 1
		Hb44	Cooling pump 2
		Hb44	Preheat pump 2
		Hb44	Reheat pump 2
		Hb45	Floating valve opening, cooling-heating/cooling
		Hb45	Floating valve opening, preheat
		Hb45	Floating valve opening, reheat
		Hb46	Floating valve closing, cooling-heating/cooling
		Hb46	Floating valve closing, preheat
		Hb46	Floating valve closing, reheat
		Hb47	Cooling-heating/cooling step 1
		Hb47	Cooling-heating/cooling step 2
		Hb47	Cooling-heating/cooling step 3
		Hb48	Preheat heater 1
		Hb48	Preheat heater 2
		Hb48	Preheat heater 3
		Hb48	Preheat heater 4
		Hb49	Reheat heater 1
		Hb49	Reheat heater 2
		Hb49	Reheat heater 3
		Hb49	Reheat heater 4
		Hb50	Auxiliary loop 1 On/Off
		Hb50	Auxiliary loop 2 On/Off
		Hb50	Auxiliary loop 3 On/Off
		Hb50	Auxiliary loop 4 On/Off

POSSIBLE OPTIONS		POSSIBLE OPTIONS	
pCO^{XS} 1+1Mbyte	1 to 3 (output 3 PWM)	pCO^{XS} 1+1Mbyte	1 to 5
pCO^{3}SMALL	1 to 4	pCO^{3}SMALL	1 to 8
pCO^{3}MEDIUM	1 to 4	pCO^{3}MEDIUM	1 to 13
pCO^{3}LARGE	1 to 6	pCO^{3}LARGE	1 to 18
pCOe	pCOe1: E1	pCOe	pCOe1: E1 to E4
	pCOe2: E2		pCOe1: E5 to E8
Belimo®	M1 to M8		

6.3.1 Configuring alarms

Configuration of alarms, the function of the contact, alarm delay and type of alarm must be completed during installation. The following table shows the settings.



Type of alarm	Enabling	Config.	Delay
Generic	Always	Hb25	Hc20
Serious	Always	Hb25	-
Frost protection	Ha16	Hb25	-
Supply filter 1	Always	Hb26	-
Supply filter 2	Always	Hb26	-
Return filter	Ha01-Hc07	Hb26	-
Supply flow switch	Always	Hb27	Startup and steady operation : Hc07
Return flow switch	Ha01-Ha04	Hb27	
Pump 1 thermal overload			
Cooling coil	Ha09-Ha10	Hb30	
Preheating	Ha09-Ha11	Hb30	
Reheating	Ha09-Ha12	Hb30	
Pump 2 thermal overload			
Cooling coil	Ha09-Ha10	Hb31	
Preheating	Ha09-Ha11	Hb31	
Reheating	Ha09-Ha12	Hb31	
Coil flow switches			
Cooling coil	Ha09	Hb32	
Preheating	Ha09	Hb32	
Reheating	Ha09	Hb32	
Fan thermal overloads			
Supply 1	Ha04	Hb29	
Supply 2	Ha01, Ha03 (Backup), Ha04	Hb29	
Return 1	Ha01, Ha04	Hb29	
Return 2	Ha01, Ha03 (Backup), Ha04	Hb29	
Humidifier	Ha01	Hb28	
Supply inverter	Ha03	Hb28	
Return inverter	Ha01, Ha03, Ha04	Hb28	
Preheat heater thermal overload	Ha05	Hb33	
Reheat heater thermal overload	Ha08	Hb33	
Dirty heat recovery unit	Ha01	Hb33	Hc18
Dirty filter	Always	Hb34	
Fire & Smoke	Always	Hb34	
Door open	Always	Hb34	
General	Always	Hb40	
BMS offline	Ge02		
Number of warnings (attempts) for pumps			
Cool/heat-cool coil	Ha10		
Preheating	Ha11		
Reheating	Ha12		

Note: following configuration, the screens in menu D show the inputs and outputs that have effectively been configured.

6.4 Device control parameters (Hc)

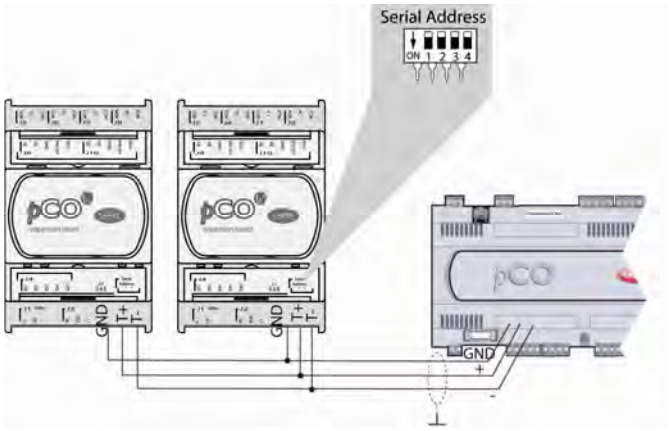
Once the devices available and the probes/digital inputs have been selected, the main control parameters are configured on the Hc screens. These include:
• selection of temperature and humidity control probes (supply, return, room);
• minimum and maximum limits for the dampers;
• fan activation delays after opening the dampers (opening time) and damper closing time after the fans stop (closing delay);
• delay time for star/delta starting;
• floating valve travel times;
• fan inverter parameters.
See the following paragraphs and the "Functions" chapter for a more detailed description of the control parameters.

Note: if a heating/cooling coil is used the heating/cooling digital output can be enabled (screen Hb42) to switch operation according to demand and the switching delay set on Hc12.

Important: the "Fieldbus" car cannot be installed on the pCOXS, however there is a version with integrated Belimo card (code PCO1MP0CX0).

6.5 pCOe expansion card connection

After having inserted the serial card (PCO100FD10) in the slot marked "field card", up to 2 pCOe expansion cards can be connected, and must be enabled on screen Ha26. Each pCOe card can be connected to:
• 4 Carel NTC probes (-50T90 °C; R/T = 10 kΩ at 25°C) or active probes: 0 to 1 Vdc, 0 to 10 Vdc, 4 to 20 mA, selectable via software in groups of two (B1, B2 and B3, B4)
• 4 digital inputs;
• 1 analogue output;
• 4 digital outputs.



Each expansion card must be set with a unique network address using the dipswitches.
The configuration screens are used to select:
• the card address;
• the functions of the probes.

Mask index	Display description	Selection
Ha26	pCOe number	1 to 2
	pCOe 1 address	1 to 5
	pCOe 2 address	1 to 5
Hb01 to Hb08	Analogue inputs	
	Supply, return, outside, room temperature	
	Supply, return, outside, room humidity	
	position ≠ 0	
	type: 4 to 20 mA ¦ 0 to 1 V ¦ 0 to 10 V	

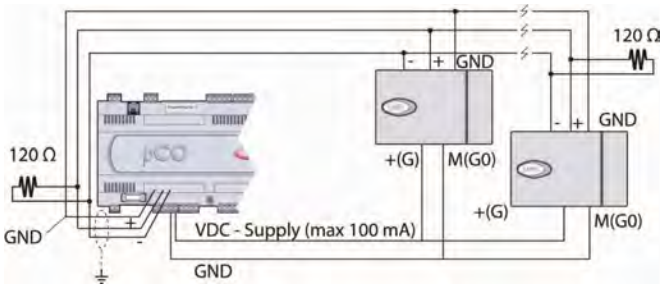
Note:
• the position of the probes connected to pCOe is defined as follows:

pCOe	pCOe 1	E1, E2, E3, E4
	pCOe 2	E5, E6, E7, E8

• E1 to E8 identify both analogue and digital inputs.

6.6 Serial probe connection

After having inserted the serial card (PCO100FD10) in the slot marked "field card", up to 6 serial probes can be connected, and must be enabled on screen Ha26.

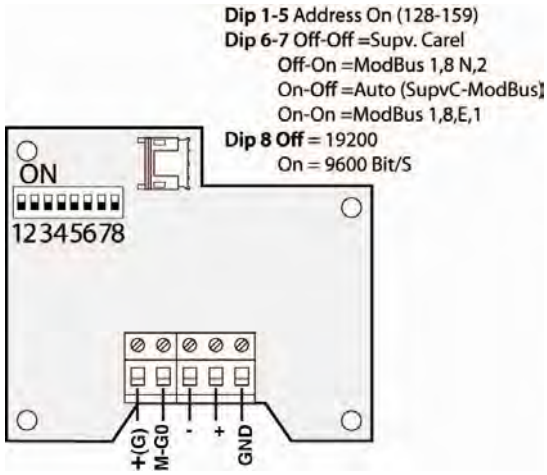


For each serial probe, the following need to be selected using the dipswitches (see the figure):
• a unique network address;
• communication speed (baud rate), the same as set on screen Ha25;
The configuration screens are used to select:
• a unique network address;
• the type, i.e. temperature or temperature/humidity probe (Ha91);
• the default probe parameter settings;
• assignment of the function to the serial probe (e.g. supply/return/room temperature /humidity probe).

Setting the parameters and the address

The default values (Baud rate = 19200, Stop bits = 2, Timeout = 300 ms, Priority = none) can be displayed and modified if necessary on screen Ha05. For DP probes, on the other hand, set dipswitches 6, 7 and 8 (6 = OFF, 7 = ON, 8 = OFF), while the address Adr = 128 to 133 is set using dipswitches 1 to 5.

Note: for further details and for the connection diagrams, see the DP serial probe manual (+030220660).



Mask index	Display description	Selection
Ha24	Protocols	
	Field port	Modbus master
Ha25	Modbus Master settings	
	Baudrate	9600 ¦ 19200
Ha26	Number of serial probes	No, 1 to 6
Ha31	Press Enter to configure serial probes → Ha91	
Ha91 to Ha96	Serial probe no. 1 to 6	
	Address	128 to 159
	Type	Temperature ¦ Temperature+humidity
	Default installation	No ¦ Yes
Hb01 to Hb08	Analogue inputs	
	Supply, return, outside, room temperature	
	Supply, return, outside, room humidity	
	position > 0	
	Min limit, max limit	

Note:
• default installation refers to the default configuration of serial probe parameters shown on the probe instruction sheet;
• also set the address, protocol and communication speed using the dipswitches on the serial probe;
• the position of the serial probes is defined as follows:

Serial probes	Temperature	T1 to T6, A1 to A6
	Humidity	H1 to H6, A1 to A6

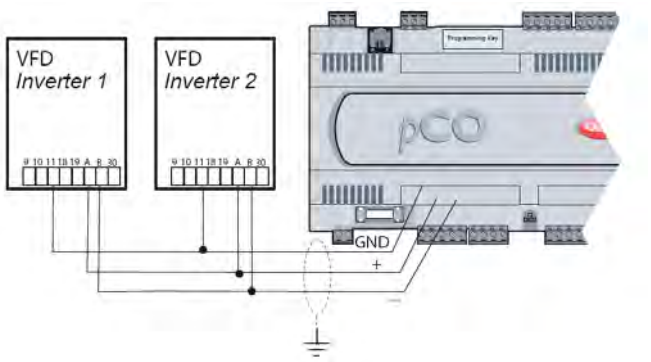
with the following meanings:

A1	Average between all probes
A2	Average between 1, 2
A3	Average between 1, 2, 3
A4	Average between 3, 4
A5	Average between 4, 5 or 4, 5, 6
A6	Average between 5, 6

6.7 VFD inverter connection

The inverter is used to manage the fan speed, for constant pressure and fixed speed control modes. After having inserted the serial card (PCO100FD10) in the slot marked "field card", up to 2 VFD inverters can be connected for the control of supply and return air fans, which must be selected on screen Ha03.

Note: serial network connection is also useful for ON/OFF or fixed speed fan control, as the inverter parameters can be set directly from the terminal.



Mask index	Display description	Selection
Ha03	Fan type	4: Inverter ¦
	Fan regulation	1: Constant pressure ¦2: Air quality ¦ 3: Fixed speed ¦
Ha24	Field port	Modbus master
Ha29	Press Enter to configure the VFD	
Ha39	Enable VFD: Modbus protocol: Yes	

Mask index	Display description	Def	Min	Max	UOM
Ha40/Ha50	Supply/return VFD				
	Address	1/2	0	999	-
	Data address	0	0	9999	-
	Data value	0	-32768	32767	-
	Default install	N	No	Yes	-
Ha46/Ha56	Supply/return VFD: motor parameters				
	Volt	0	180	690	V
	Cosfi	0.0	0.3	0.99	-
	Frequency	0	30	320	Hz
	Speed	0	300	20000	rpm
	Current	0	-999.9	999.9	A
	Current limit	0	0	999.9	A
Hc40/Hc50	Supply/return VFD				
	Volt at 0 Hz	0	0	40	%
	Switch frequency	0	1	16	kHz
	V/ f curve midpoint				
	Voltage	0	0	100	%
	Frequency	0	0	320	Hz

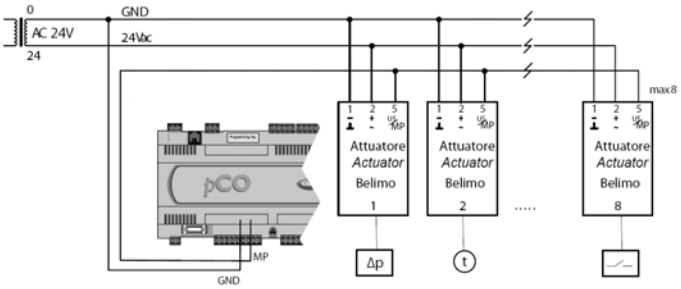
Mask index	Display description	Selection
Ha41/Ha51	Supply/return VFD	
	Control place	1: I/O terminal ¦2:Keypad ¦ 3: Fieldbus
	Speed reference type	0:Ain1 ¦ 1:Ain2 ¦ 2:Keypad ¦ 3: Fieldbus ¦ 4: Motor potentiometer ¦ 5:PID regulation
	Rotation type	Clockwise ¦ anticlockwise
Ha42/Ha52	Supply/return VFD	
	Motor control mode	Frequency ¦ speed
	Start function	Ramp ¦ flying start
	Stop function	Ramp ¦ coasting
Ha43/Ha53, Ha44/Ha54, Ha45/Ha55	Action when in fault	See parameters table
Hc41/ Hc51	Supply/return VFD	
	V/f ratio	Linear ¦ squared¦ programmable ¦ linear with flux optimisation
	V/f Optimisation	Not used ¦ automatic boost ¦
	Auto restart	Not used ¦ used

Mask index	Display description	Def	Min	Max	UOM
Hc42/ Hc52	Supply/return VFD				
	Min/ max frequency	0	0	Max freq.	Hz
	Acceleration time	1	0.1	3200	s
	Deceleration time	1	0.1	3200	s

Note:
• the "control place" parameter establishes the source of the signal to the start/stop the fan. The "speed reference" parameter establishes the source of the speed/frequency reference. See the VFD inverter manual;
• for on/off fans, the VFD can be configured to set the parameters from the display.

6.8 Belimo actuator connection

After having inserted the serial card (PCO100FD10) in the slot marked "field card" (for the pCO1XS, code PCO1MP0CX0 is available with integrated Belimo card), up to 8 Belimo actuators (dampers, valves, etc.) can be connected, and must be selected on screen Ha27. The Belimo protocol must be set on screen Ha24. Each Belimo actuator can be connected to:
• an NTC probe;
• one 0 to 1 V or 0 to 10 V input;
• one digital input.



The following parameters are selected on the screens for each actuator:
• actuator address setting procedure, manual or automatic;
• type of probe connected and the minimum/ maximum limits;
• function of the probe.
In addition, the adaptation procedure needs to be run to align the position.

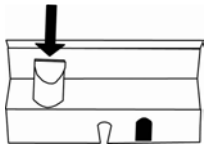
Mask index	Display description	Selection
Ha24	Protocol	
	…	
	Field port	Belimo
Ha27	Belimo devices	
	Number of actuators	0 to 8
Ha28	Press Enter to configure Belimo actuators →Ha60	
Ha60	Belimo 1 to Belimo 8	
Ha60, Ha63 to Ha81	Actuator type (read-only)	1: None ¦ 2: Air actuator ¦ 3: Valve actuator ¦ 4: Valve actuator 5: None ¦6: Fire-smoke damper ¦ 7: None ¦ 8: VAV Smoke-fire damper ¦ 9: None
	Addressing mode	0: Manual 1: Auto
	SN: 00000-00000-000-000	
	Address actuator	0:No¦ 1:Yes
Ha61, Ha64 to Ha82	Enable external input/probe	0:No¦ 1:Yes
	Type	NTC ¦ 0 to 1 V ¦ 0 to 10 V ¦ ON/OFF
	Min value	-999.9 to Max value
	Max value	Min value to 999.9
Ha62, Ha65 to Ha83	Position or air flow limits	
	Minimum	0 to Maximum
	Maximum	Minimum to 100
Gg60 to Gg67	Belimo 1 to Belimo 8	
	Start adaptation	No
	Start testrun	No
	Adapted angle	Yes
	Alarms reset	No

6.8.1 Setting the Belimo actuator address

There are two procedures for setting the address:
1) automatic;
2) manual.

Automatic address setting
• identify the serial number from the barcode (see the figure);
• select "automatic" address setting mode;
• enter the number from the SN field in screens H60 to Ha81 (actuators 1 to 8);
• enter Yes in the Address actuator field;
• after a few seconds the message "address setting OK" is displayed to confirm that the address has been set successfully.

Manual address setting
A: select "manual" address setting mode;
B: enter Yes in the Address actuator field;
C: press the button indicated by the arrow repeatedly (see the figure);
D: after a few seconds the message "address setting OK" is displayed to confirm that the address has been set successfully.

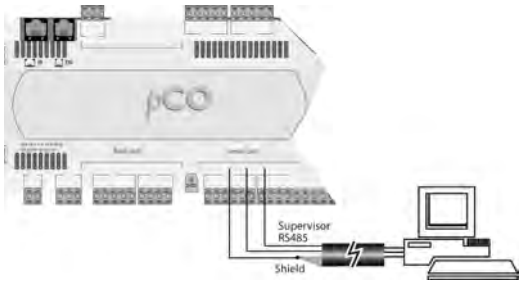


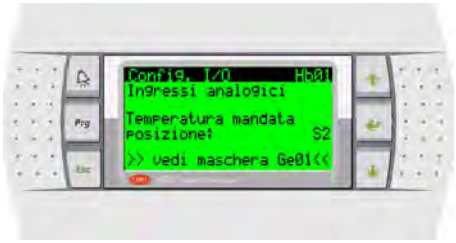
Note: In the event of errors, to reset the address, repeat steps A and B and then set the "Address actuator" field to No.

6.9 Probes from supervisor

The BMS port fitted with the RS485 serial card can be connected to a supervisor (PlantVisorPro, PlantWatchPro) that sends the values of up to 4 probes. The BMS serial protocol must be set (Ha24) to "BMS", while the BMS configuration (Ge01) must be set by selecting the protocol (e.g. Modbus), communication speed and network address. Supervisor probes must be enabled (Ha30), and the backup probes used after a certain timeout following interruption to communication defined, and finally the functions assigned on the "Hb" screens. The supervisor probes are identified by letters S1 to S4.

Note: the values of the probes and digital inputs can be written by the supervisor, however analogue inputs can be set as backup only for the probes (not for the digital inputs);





Mask index	Display description	Selection
Ha24	Protocol	
	pLAN port	pLAN
	BMS port	BMS ¦ Winload
	Field port	Modbus master ¦ Belimo
Ha30	Enable BMS probes and digital inputs	No ¦ Yes
	Backup probe 1	None, AIN1 to AIN10
	Backup probe 2	None, AIN1 to AIN10
	Backup probe 3	None, AIN1 to AIN10
	Backup probe 4	None, AIN1 to AIN10
Ge01	BMS configuration	
	BMS protocol	Modbus ¦ LON ¦ CAREL
	Baud rate	1200 ¦ 2400 ¦ 4800 ¦ 9600 ¦ 19200
	Address	0 to 207
Ge02	BMS offline alarm enable	No ¦ Yes
	Timeout	0 to 900 s

7 COMMISSIONING

Commissioning refers to installation of the electrical panel in the field and setting the air handling unit application software parameters, as well as all the operations needed to complete the setup of the devices. The Commissioning procedure is activated on the screen Ge03, after having fitted the BMS RS485 card on the controller and established the connection to a personal computer running the pCO Manager program (see the appendix).

7.1 Loading the configuration

If necessary, load the configuration saved following the software configuration procedure, on screen Gfd01. Once the parameters have been loaded, the following operations are possible:

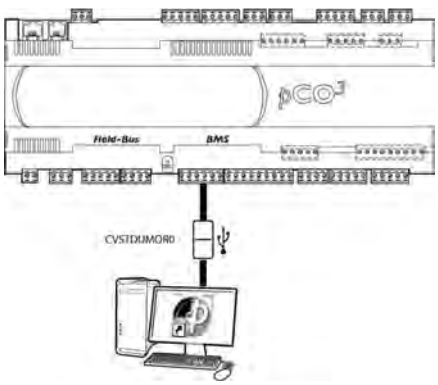
1) verify correspondence of the I/Os to the design AHU;
2) set the PID parameters for temperature and humidity control, air quality and advanced control functions (cascade, supply limits, compensation, etc..). See the "Functions" chapter;
3) set the auxiliary control loops, if featured;
4) set the baud rate and serial address for Fieldbus and BMS serial communication;
5) calibrate the probes;
6) manually calibrate the fans, coil actuators, humidifier, and activate purging.

Note: see the screens in menus Ga, Gb, Gc, Gfc, Ge, Gg and the "Functions" chapter.

7.2 Commissioning

Warning: before performing any operation on the pCO board, disconnect power to the device by moving the main switch on the electrical panel to OFF.
To configure the parameters using PCO Manager:
1) Disconnect any BMS cards other than the RS485 card (e.g. LON);
2) Connect the BMS RS485 card;
3) Activate the Commissioning service on screen Ge03;

4) Connect to the computer via the USB/RS485 connector;



5) Perform the commissioning procedure using pCO Manager. See the appendix;
6) At the end the operations, stop the Commissioning service.
7) Reconnect the BMS card and restore power.

Note: the commissioning service automatically sets the BMS protocol to "Winload". Once the procedure has ended, the protocol automatically returns to "BMS", allowing reconnection to the supervisor.

7.3 Probe calibration

In menus Gfb01 to Gfb08, calibrate the probes if necessary and check the correct reading against a sample probe.
See the parameters table.

7.4 Setting the control parameters

To set the control parameters see the "Software configuration" and "Functions" chapters. The parameters can be modified from the terminal or a personal computer using the pCO Manager program. See the appendix.

7.5 Setting the hour counters

On screens Gfa01 to Gfa06 (see the parameters table) a maximum number of operating hours before maintenance is required can be set for each device. On exceeding the maintenance hours, a "warning" is signalled on the display and recorded in the alarm log, without affecting control. Access screens Gfa01 to Gfa06 again to reset the warning. The purpose is to allow service personnel to be notified to ensure preventive maintenance.

7.6 Enthalpy management

Enter the atmospheric pressure for parameter Gfc16 to allow the controller to correctly calculate the values on the psychrometric chart.

Mask index	Display description	Def	UOM	Min	Max
Gfc16	Enthalpy management				
	Atmospheric pressure	1090	mbar	600	1100

7.7 I/O test

Screens He01 to He50 can be used to test the actuators during installation, see menu Gg01. Modulating fan actuators can be adjusted from 0 to 100% to achieve design air flow-rates. For the digital outputs, 0% corresponds to OFF and 100% to ON.

8 FUNCTIONS

FLSTDMAHUE features advanced control functions that can be activated based on the devices installed on the air handling unit:

- Temperature and humidity control;
- Freecooling and freeheating;
- Heat recovery;
- Air quality;
- Air cleaning (purging);
- Priority to temperature or humidity control;
- Set point compensation;
- Automatic summer/winter (cooling/heating) changeover;
- Temperature and humidity supply limits;
- Auxiliary control loops;
- Frost protection and room protection.

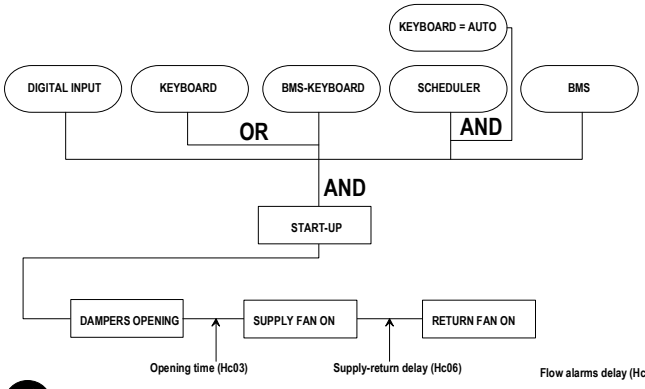
The possible operations are described below; additional custom functions can be created using the 1tool programming environment modules. Refer to this for further information.

8.1 On/Off

8.1.1 ON

Before switching On, the AHU temporarily goes through the Start-up stage, during which the controller checks for any alarms, opens the dampers and when open starts the supply and return air fans. ON status requires the following, with a logical AND relationship:

- digital input;
- keypad or BMS with keypad override;
- scheduler (time bands)
- BMS.



Note:

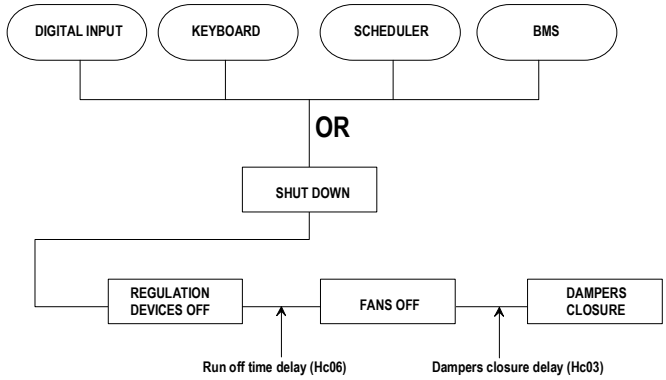
- the keypad (A01) switches the AHU ON if "Comfort", "Precomfort" or "Economy" has been set;
- BMS with keypad override means the possibility to override the selection made on the keypad using a BMS variable;
- ON from scheduler requires the keypad to be set to AUTO;
- ON from BMS is a further ON signal using a separate variable.

See the list of BMS variables.

8.1.2 OFF

Before switching Off, the AHU temporarily goes through the Shutdown stage, during which the controller stops the devices and fans and closes the dampers. ON status requires the following, with a logical OR relationship:

- digital input;
- keypad;
- scheduler
- BMS.



8.2 Set point

After having selected the main temperature and humidity probes and cooling and heating set points for each operating mode (screens B02, B03, B04), screen B01 displays the temperature and humidity set points. The maximum and minimum limits for the temperature and humidity set points in cooling and heating can be set in the Service menu, on screens Gfc02 and Gfc03. For the temperature set point, an offset from analogue input can be enabled on Ha19, and the effect of the offset seen on B01, i.e. display the current working set point and the affect of the offset on the set points defined on B02, B03, B04. The following inputs can also be enabled, configured on Hb24:

1) change in set point from comfort to economy from digital input , enabled on Ha18 and configured on Hb24 (double set point);
2) remote On/Off, directly configured on Hb24.

Mask index	Display description	Selection
Ha18	Setpoint from digital input	0:No¦ 1:Yes
Hb24	Double set point	Position ≠0
Ha19	Enable setpoint offset by analog input	0:No¦ 1:Yes

Mask index	Display description	Def	Min	Max	UOM
B02/B03/ B04	Comfort/Pre-comfort/Economy temp. summer	-	Lim. Inf. (Gfc02)	Lim. Sup. (Gfc02)	°C
B02/B03/ B04	Comfort/Pre-comfort/Economy temp. winter	-	Lim. Inf. (Gfc02)	Lim. Sup. (Gfc02)	°C
Gfc02	Temperature set limits				
	Summer low	15	-99.9	99.9	°C
	Summer high	35	Summer low	99.9	°C
	Winter low	15	-99.9	99.9	°C
	Winter high	35	Winter low	99.9	°C
Gfc03	Humidity set limits				
	Summer low	30	0	100	%rH
	Summer high	90	Summer low	100	%rH
	Winter low	30	0	100	%rH
	Winter high	90	Winter low	100	%rH

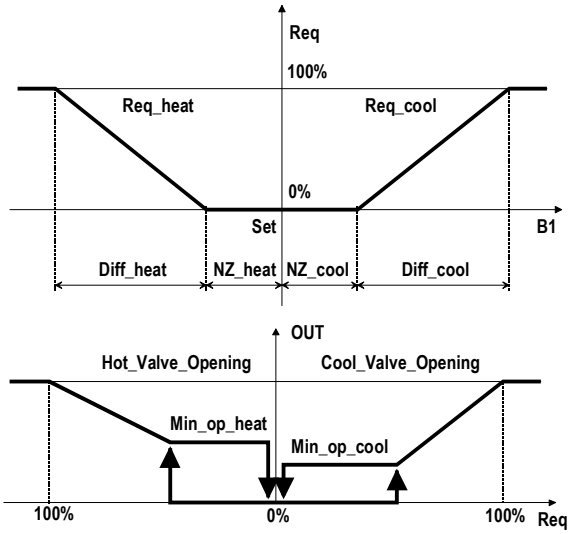
8.3 Temperature control

8.3.1 Enabling

The following need to be enabled:
1) the probe used for control (Hc01);
2) the type of control (proportional, proportional+integral, proportional+integral+derivative), the same for heating and for cooling (Gfc04);
3) the PID control parameters for winter and summer operation and the corresponding neutral zone (Gfc05, Gfc06);
3) the cooling and heating temperature set point limits (paragraph 8.2), if control is on the return/room probe;
4) if necessary, cooling in winter and heating in summer (auto heat/cool, Gfc04);
5) if the reheating coil only operates to supplement the action of the preheating coil (integration) or also to compensate (compensation) for the lowering in temperature due to dehumidification (Ha08).

Note:

• the heating and cooling coils have a minimum opening settable by parameter, therefore if the control probe value does not deviate from the set point by more than the neutral zone and the resulting request is not sufficient to reach the minimum opening, the valve won't open; see the following graphs;
• control normally performs heating in winter and cooling in summer. Only if auto cool/heat is set (Gfc04) heating can also be applied in summer and cooling in winter, based on the current set point;
• for simplicity the following graphs refer to proportional control only;
• see available literature for more complete details on PID control.



Key			
Req_heat	Heating request	Req_cool	Cooling request
Req	Request	B1	Control probe
Diff_cool	Cooling differential	Diff_heat	Heating differential
Set	Set point		
Min_op_cool	Cooling valve minimum opening	Min_op_heat	Heating valve minimum opening
NZ_cool	Neutral zone in cooling	NZ_heat	Neutral zone in heating

Mask index	Display description	Selection
Ha08	Reheating output	Integration ¦ Compensation ¦ Compensation + integration
Hc01	Main regulation probe selection	
	Temperature	Return ¦ supply ¦ room
Gfc04	Regulation type	Proportional ¦ Proportional+integral ¦ PID
	Auto cool/heat	NO ¦ YES

Mask index	Display description	Def	Min	Max	U.M
Gfc02	Temperature set limits				
	Summer low	15	-99.9	99.9	°C
	Summer high	35	Summer low	99.9	°C
	Winter low	15	-99.9	99.9	°C
	Winter high	35	Winter low	99.9	°C
Gfc05	Cooling regulation				
	Differential	2	0	99.9	°C
	Neutral zone	1	0	99	°C
	Integral time	300	0	999	s
	Derivative time	0	0	999	s
Gfc06	Control hot				
	Differential	2	0	99.9	°C
	Neutral zone	1	0	99	°C
	Integral time	300	0	999	s
	Derivative time	0	0	999	s
Gfc23	Minimum cooling valve opening				
	Cooling	0	0	100	%
Gfc24	Minimum opening heating valve	0	0	100	%
Gfc26	Minimum heat/cool valve opening				
	Cooling	0	0	100	%

Note: the graphs show that the valves do not open inside the neutral zone around the set point, therefore the heating or cooling action is not performed.

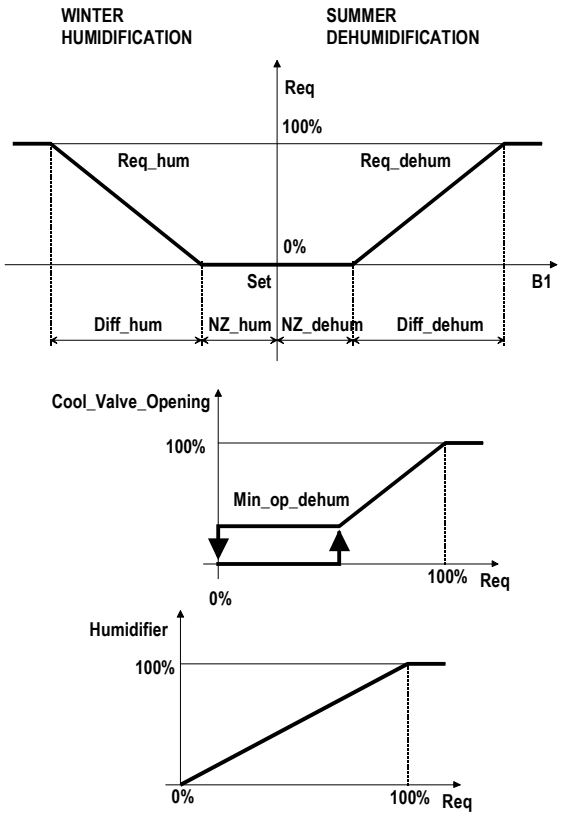
8.4 Humidity control

8.4.1 Enabling

The following must be enabled or selected:
1) the humidifier (Ha01);
2) the type of humidifier (Ha13) and in the event of adiabatic humidifier the supply temperature lower limit (Gfc35);
3) the probe used for humidity control (Hc01);
4) for adiabatic humidifiers, the air preheating probe (Gfc25, Gfc27);
5) the type of control (proportional, proportional+integral, proportional+integral+derivative, on Gfc10);
6) the PID control parameters for humidification and dehumidification and the corresponding neutral zone (Gfc12, Gfc11);
7) the humidity set point limits in summer and winter (paragraph 8.2);
8) humidification in summer or dehumidification in winter according to request (auto hum/dehum, Gfc10);
9) whether the reheating coil acts to supplement the preheating coil (integration) or also to compensate for the reduction in temperature due to dehumidification (Gfc28).

Note:

• control normally performs humidification in winter and dehumidification in summer. Only if auto hum/dehum is set (Gfc10) humidification is also performed in summer and dehumidification in winter;
• the minimum opening in dehumidification mode may be different from that in cooling because represents the minimum passage of water that manufactures dehumidification.



Key

Req	Request	Set	Humidity set point
Diff_dehum	Dehumidification differential	Diff_hum	Humidification differential
NZ_hum	Neutral zone in humidification	NZ_dehum	Neutral zone in dehumidification
B1	Control probe	Min_op_dehum	Cooling valve minimum opening

Mask index	Display description	Selection
Ha01	Main device enable	
	Humidifier	Disabled ¦ Enabled
Ha06	Dehumidification	1: Request humidity ¦ 2: Point dew ¦3: Disabled
Ha08	Reheating output	Integration ¦ Compensation ¦ Compensation+ Integration
Ha13	Humidifier	
	Type	Isothermal (ON/OFF control) ¦ Isothermal (Control model.) ¦ Adiabatic (ON/OFF control) ¦ Adiabatic (Control model.)
Hc01	Main regulation probe selection	
	Humidity	Return ¦ supply ¦ room
Gfc10	Humidity regulation	
	Regulation type	Proportional ¦Proportional+integral ¦ PID
	Auto hum/dehum	No ¦ Yes
Gfc35	Adiabatic humidifier - Supply low temperature limit	
	Enable limit	No ¦ Yes

Mask index	Display description	Def	Min	Max	UOM
B02/B03/B04	Comfort/Pre-comfort/Economy temp. summer	-	0	100	% RH
B02/B03/B04	Comfort/Pre-comfort/Economy temp. winter	-	0	100	% RH
Gfc11	Dehumidification regulation				
	Differential	5	0	100	% RH
	Neutral zone	5	0	100	% RH
	Integral time	300	0	999	s
	Derivative time	0	0	999	s
Gfc12	Humidification regulation				
	Differential	4	0	100	% RH
	Neutral zone	2	0	100	% RH
	Integral time	300	0	999	s
	Derivative time	0	0	999	s
Gfc23	Minimum cooling valve opening				
	Dehumidification	0	0	100	%
Gfc26	Minimum heat/cool valve opening				
	Dehumidification	0	0	100	%

8.4.2 Humidification control

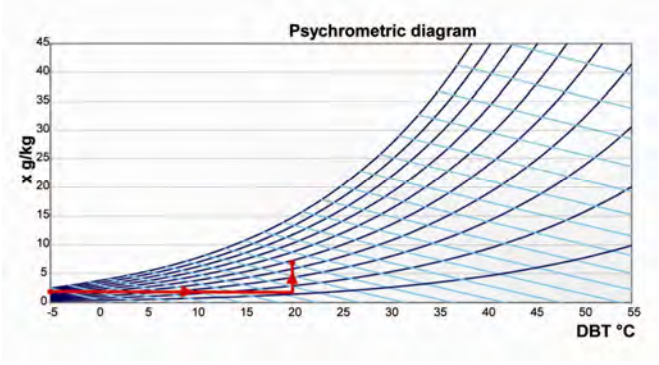
The control parameters are as follows:

Mask index	Display description	Selection
Ha05	Temperature probe when humidifying (preheating coil)	Off coil ¦ Regulation
Ha07	Temperature probe when humidifying (heat-cool coil)	Off coil ¦ Regulation
Ha13	Humidifier type	Isothermal ¦ adiabatic

Mask index	Display description	Def	Min	Max	UOM
Gfc25	Preheating coil settings when humidifying				
	Setpoint	23	-99.9	99.9	°C
	Differential	2	0	99.9	°C
Gfc27	Heat/cool coil settings when humidifying				
	Setpoint	20	-99.9	99.9	°C
	Differential	2	0	99.9	°C
Gfc35	Adiabatic humidifier – Supply low temperature limit				
	Enable limit	No	No	Yes	-
	Setpoint	15	0	99.9	°C
	Differential	2	0	99.9	°C

Control is performed in two ways, according to the type of humidifier:

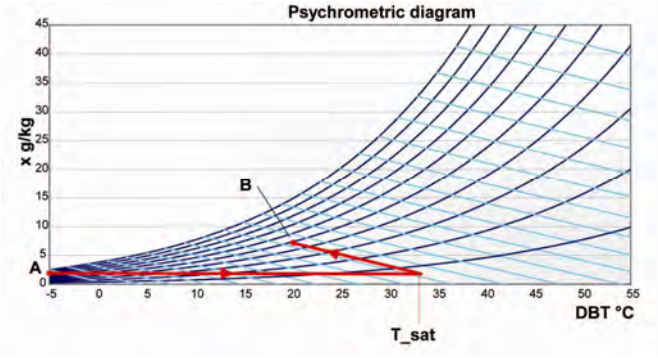
1. isothermal: air humidification is performed with a negligible variation in the supply air temperature. The controller sends the signal to start steam production and/or modulate output using a 0 to 10 V signal until reaching the humidity set point. Example of humidification from point A (-5 °C, 85 % RH) to point B (20 °C, 50 % RH).



Key

x	Absolute humidity	DBT	Dry bulb temperature

2. adiabatic: evaporation of the droplets of atomised water brings about cooling of up to 10 °C if the air is warm and dry to start with. To compensate for this effect and increase humidification efficiency, the preheating coil is activated based on the saturation probe and in any case a minimum air temperature limit is set for the supply probe so as to stop humidification if the air temperature falls too low. Example of humidification from point A (-5 °C, 85 % RH) to point B (20 °C, 50 % RH).

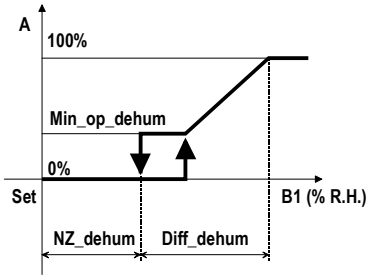


Key

x	Absolute humidity	DBT	Dry bulb temperature

8.4.3 Dehumidification control

Control is performed in two ways, according to the settings:
1) humidity request: based on the humidity control probe reading, the cooling actuator is modulated proportionally to request so as to reach the humidity set point.

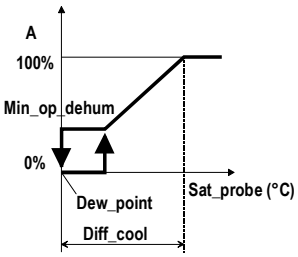


Key

A	Cooling actuator opening	Set	Humidity set point
B1	Humidity control probe	Min_op_dehum	Cooling coil minimum opening
NZ_dehum	Neutral zone in dehumidification	Diff_dehum	Dehumidification differential

Mask index	Display description	Selection
Ha06	Dehumidification	Humidity request

2) dew point: the dehumidification request is managed based on the humidity set point and the differential, according to the humidity measured by the control probe. Once the request signal is received, the controller uses the dewpoint calculation starting from the humidity and temperature set point to adjust the cooling actuator, comparing the set point against the value measured by the saturation temperature probe located downstream of the cooling coil or the humidifier, if featured. As soon as the humidity probe detects a dehumidification request, the control calculates the final dewpoint and sets this as the temperature set point (T_set_R) after the cooling coil.

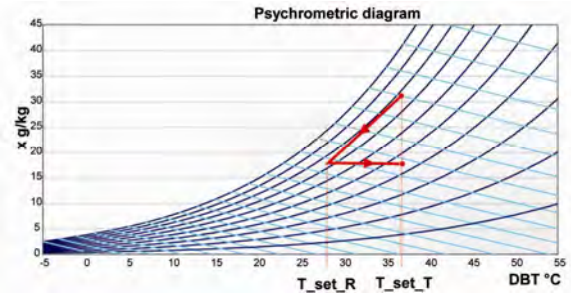


Key

A	Cooling actuator opening	Dew_point	Dewpoint
Sat_probe	Saturation probe	Min_op	Coil minimum opening

Mask index	Display description	Selection
Ha06	Dehumidification	On dew point

Mask index	Display description	Def	Min	Max	UOM
Gfc05	Cooling regulation				
	Differential	2	0	99.9	°C



Key

T_set_R	Dewpoint	T_set_T	Temperature set point

For both dehumidification methods, the reheating coil will, based on the supply probe reading, reheat the air to the temperature set point (Gfc28). The control algorithm is proportional only, with its own differential.

Mask index	Display description	Def	Min	Max	UOM
Gfc28	Reheating coil compensation setting				
	Setpoint	24	-99.9	99.9	°C
	Differential	3	0	99.9	°C

8.5 Temperature / humidity control priority

To control temperature and humidity, the coils and the humidifier must be enabled and the types must be set. The following also need to be activated and set:
1) the temperature and humidity control probes;
2) the dehumidification function and mode;
3) the humidifier and control probe;
4) the temperature and humidity set points.

Simultaneous requests for:
1) heating and humidification;
2) dehumidification and cooling:
are not incompatible as regards activation of the devices, consequently if a priority has been set the controller will try to satisfy both requests. If this involves the same actuator, the latter operates based on the higher of the two requests. To prevent uncomfortable situations being created, the "supply limits" function can be used.

On the other hand, in the event of simultaneous requests for:
1) heating and dehumidification;

2) cooling and humidification,
control is performed according to the table below, based on the whether the priority is set for temperature or humidity.

TEMPERATURE PRIORITY

Temperature request	Humidity request	Preheating coil	Cooling coil	Reheating coil	Humidifier
Heating	Dehumidification	Based on temperature control probe	Off	If "integration" cascade control	Off
Cooling	Humidification	Off	Based on temperature control probe	Off	Waits for temperature set point to be reached

Note: in the case of request of cooling and dehumidification the control considers the greater than the two required on the cooling coil.

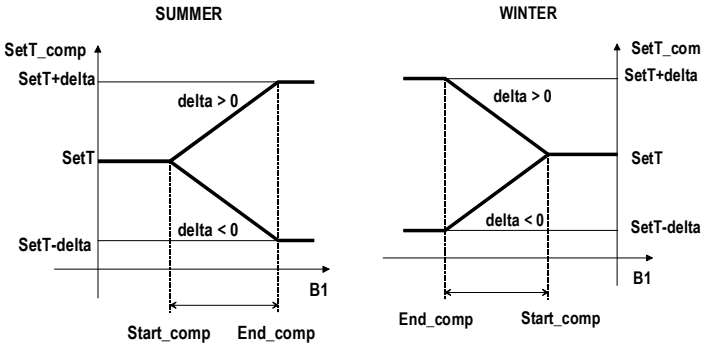
HUMIDITY PRIORITY

Temperature request	Humidity request	Preheating coil	Cooling coil	Reheating coil	Humidifier
Heating	Dehumidification	Waits for humidity set point to be reached	Based on humidity control probe	If "compensation" acts on supply	Off
Cooling	Humidification	Acts on saturated probe set point if humidifier = adiabatic	Waits for humidity set point to be reached	Off due to cooling	Based on humidity control probe

8.6 Set point compensation

Set point compensation adjusts the set point defined by the user with an offset that depends on a probe. This function in some cases ensures energy saving by adapting the set point to the outside temperature, while still guaranteeing suitable values for comfort. A temperature set point of 23 °C for example can be adjusted to 21 °C when the climate is extreme. In other cases, it's used to:
1) improve comfort, reducing the difference between the outside temperature and the inside or room temperature;
2) integrate another air-conditioning system: for example, if in summer at 7 in the morning the outside temperature is lower than the room temperature, the room probe can be used as the compensation probe and the supply probe as the control probe to lower the set point and exploit freecooling.
The following are possible:
1) differentiate between compensation in summer and winter;
2) select the probe used for compensation, between outside, supply, return and room probe;
3) increase or decrease the set point being compensated.

Note: compensation is disabled if the control probe and the compensation probe are the same.
Below is an example with the compensation probe set as the outside temperature probe that compensates the room temperature set point.



Key

SetT	Temperature set point	End_comp	End compensation
Delta	Compensation delta	B1	Compensation probe
Start_comp	Start compensation	SetT_comp	Compensation set point

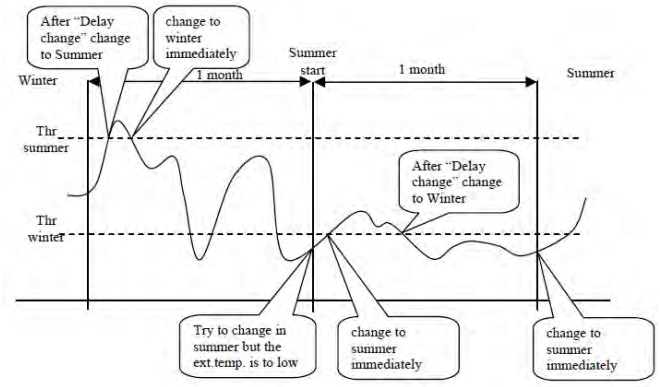
Mask index	Display description	Selection
Hc01	Main regulation probe selection	
	Temperature	Return ¦ supply ¦ room
Gfc08	Type of summer set point compensation	None ¦ external ¦ room ¦ supply ¦ return
	Compensation delta	2 °C
	Compensation start	25 °C
	Compensation end	32 °C
Gfc09	Type of winter set point compensation	None ¦ external ¦ room ¦ supply ¦ return
	Compensation delta	-2 °C
	Compensation start	0 °C
	Compensation end	-8 °C

8.7 Summer/winter changeover

This changeover can be performed from the keypad, digital input or supervisor (BMS), based on the heating/cooling coil temperature or automatically. Summer/winter changeover switches the control set point from summer to winter. The basic function involves switching from cooling in summer to heating in winter. If "Auto" cool/heat is active (Gfc04) both heating and cooling are possible in summer and winter.

Mask index	Display description	Selection
Gc01	Season selection from	Keypad ¦ Digital input ¦ B.M.S ¦ Keypad /B.M.S. ¦Auto ¦ H_2O Temperature
Gc02	Set season	Auto ¦ Fix days
Gfc04	Temperature regulation	
	Auto cool/heat	No ¦ Yes

For automatic season changeover, on screen Gc01 and Gc02 the season must be selected as "Auto". Automatic selection allows the changeover to be managed "actively", in the sense that for one month before and one month after the set date the season changeover can be brought forward or postponed if the outside temperature remains above or below a certain level for a certain set time in hours (both to enter and exit the function, eliminating swings in system operation). This allows a temporary change in season (and corresponding set point) without having to act manually to adapt for days with uncharacteristic outside temperatures for that period.



Mask index	Display description	Def	Min	Max	UOM
Gc02	Set season				
	Summer start	15/05	01/01	31/12	dd/mm
	Winter start	30/09	01/01	31/12	dd/mm
	Threshold summer	25	-99.9	99.9	°C
	Threshold winter	10	-99.9	99.9	°C
	Delay change	1	0	999	hour

8.8 Freecooling and freeheating

Note: when the AHU is in freecooling/freeheating mode, the bypass damper on the heat recovery unit is open and consequently heat recovery is disabled.

8.8.1 Definition

In air-conditioning systems the freecooling/freeheating functions are used to cool/heat for free using only a part or all the fresh air intake, when the temperature and relative humidity conditions allow. Freecooling and freeheating are thus considered free sources of energy, activated with priority over cascade control in cooling and heating. Demand is shared between the various cascade control devices. The function has two stages:
1) check whether the outside temperature or enthalpy conditions are favourable compared to the return air conditions;
2) control the opening of the fresh air damper based on the cooling/heating request.

8.8.2 Enabling

The freecooling/freeheating function can **only** be enabled if the mixing damper is installed and the corresponding output is configured.

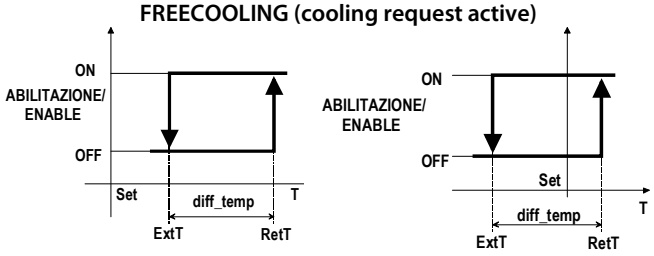
Note: if the AHU has the fresh air damper only (not the mixing damper) the quantity of fresh air is not controlled.

Mask index	Display description	Selection
Ha02	Dampers type	1: Fresh air (On/Off) ¦ 2: Fresh air (Mod) ¦3: Fresh air + Mixing ¦ 4: Fresh air + Mixing + Exhaust ¦ 5: Fresh air (Mod) + Exhaust
	Freecooling	1: None ¦ 2: Temperature ¦ 3: Enthalpy
	Freeheating	1: None ¦ 2: Temperature ¦ 3: Enthalpy
Hb39, Hb53	Fresh air damper	Position ≠ 0
Hb54	Mixing damper	Position ≠ 0
Hb55	Exhaust damper	Position ≠ 0

8.8.3 Activation by temperature

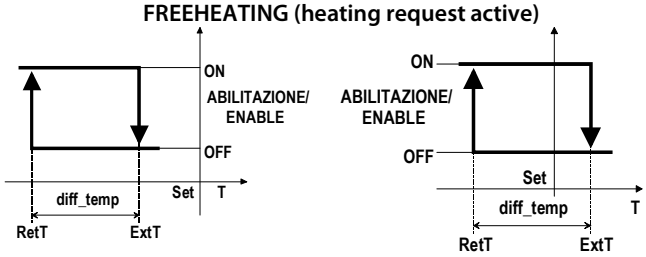
Note: the following graphs consider the outside temperature to be constant.
Freecooling and freeheating by temperature are activated when:
1) the outside temperature is closer to the temperature set point than the return temperature, or
2) the outside and return temperature straddle the set point.

FREECOOLING (cooling request active)



ON: RetT- ExtT> diff_temp; OFF: RetT-ExtT<0

FREEHEATING (heating request active)



ON: ExtT-RetT> diff_temp; OFF: ExtT-RetT<0

Key

RetT	Return temperature	Set	Set point
ExtT	Outside temperature	diff_temp	Temperature differential
T	Temperature		

Note: for control by enthalpy, the same rules apply for activation, with the values calculated enthalpy based on the temperature and humidity set points and the outside air conditions, displayed on screen D06. In this case the **enthalpy activation differential** is fixed at 4 kJ/kg. See the following paragraph.

Temperature differentials are needed to determine whether it's efficient to sue freecooling/freeheating, considering that the higher the deviation between outside and return temperatures, the more efficient the function will be.

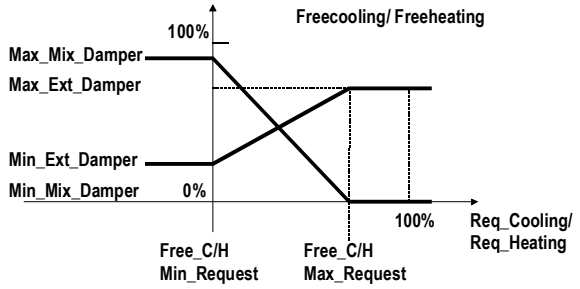
Mask index	Display description	Def	Min	Max	UOM
Gfc15	Freecooling/Freeheating dampers setting				
	Temperature differential	4	0	99.9	°C

8.8.4 Temperature control

The control differentials used are those that apply to normal temperature control.

Mask index	Display description	Def	Min	Max	UOM
Gfc05	Cooling regulation				
	Differential	2	0	99.9	°C
Gfc06	Heating regulation				
	Differential	2	0	99.9	°C

When the function has been activated, the fresh air damper and mixing damper are controlled proportionally to the cooling/heating request with the percentages defined on Gfc20/ Gfc21. The fresh air damper opens and the mixing damper closes to compensate for the pressure drop. If the fresh air damper and exhaust damper are used, the two control signals are identical.



Key	
Max_Mix_Damper	Mixing damper maximum opening
Max_Ext_Damper	Fresh air damper maximum opening
Min_Mix_Damper	Mixing damper minimum opening
Min_Ext_Damper	Fresh air damper minimum opening
Req_cooling/heating	Cooling/heating request

The limits for opening the damper are set in the manufacturer parameters menu, Hc02.

Mask index	Display description	Def	Min	Max	UOM
Hc02	Dampers limits setting				
	Fresh air damper - min	-	0	100	%
	Fresh air damper - max	-	30	100	%
	Mixing damper - min	-	0	100	%
	Mixing damper - max	-	0	100	%

To exploit freecooling/freeheating to the maximum, a delay can be set when starting the unit for activation of the other devices in cascade control.

Mask index	Display description	Def	Min	Max	UOM
Hc03	Damper setting				
	Coil start delay	0	0	120	min

Note:

• if air quality control is also enabled (see. Ha02), when both functions are active the fresh air damper will open according to the higher request;

• in the winter season, freecooling is especially useful for cooling. A typical example a crowded shopping centre or conference centre. To do this, enable "auto" mode on Gfc04 and set the freecooling parameters accordingly.

8.8.5 Activation by enthalpy

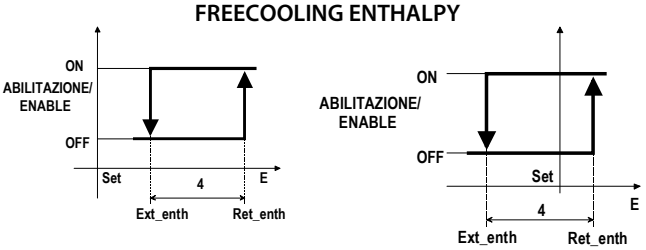
Note: the following graphs consider the outside enthalpy to be constant.

Freecooling and freeheating by enthalpy are activated when:

1) the outside enthalpy is closer to the enthalpy set point than the return enthalpy, or alternatively

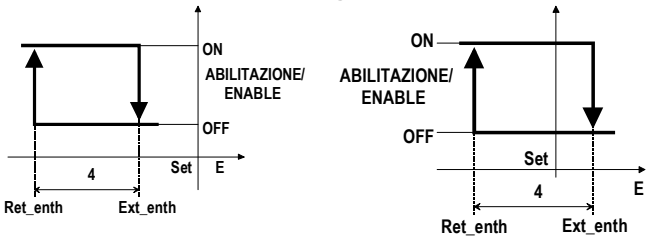
2) the outside and return enthalpy straddle the set point.

FREECOOLING ENTHALPY



ON: Ret_Enth- Ext_enth> 4; OFF: Ret_Enth-Ext_Enth<0

FREEHEATING ENTHALPY



ON: Ext_Enth-Ret_enth> 4; OFF: Ext_enth-Ret_Enth<0

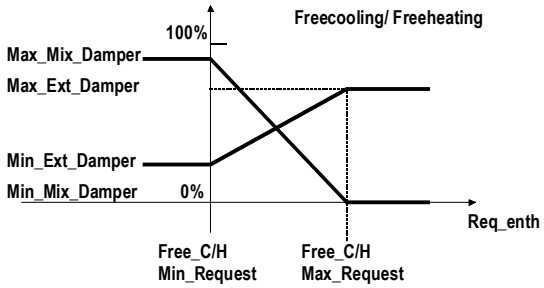
Key			
Ret_enth	Return enthalpy	Set	Enthalpy set point
Ext_enth	Outside enthalpy	E	Enthalpy

8.8.6 Enthalpy control

The enthalpy control set point and supply, return and outside enthalpy values can be seen on screen D06. The control differential is set on screen Gfc15.

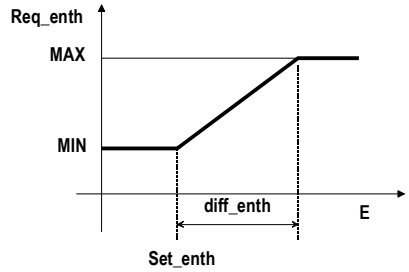
Mask index	Display description	Def	Min	Max	UOM
D06	Enthalpy				
	Supply	-	0	99.9	kJ/kg
	Return	-	0	99.9	kJ/kg
	External	-	0	99.9	kJ/kg
	Setpoint	-	0	99.9	kJ/kg
Gfc15	Freecooling/ Freeheating dampers settings				
	Enthalpy differential	5	0	99.9	kJ/kg

When the function has been activated, the fresh air damper and mixing damper are controlled proportionally to the freecooling/freeheating enthalpy request. The fresh air damper opens and the mixing damper closes to compensate for the pressure drop. If the fresh air damper and exhaust damper are used, the two control signals are identical.



Key	
Max_Mix_Damper	Mixing damper maximum opening
Max_Ext_Damper	Fresh air damper maximum opening
Min_Mix_Damper	Mixing damper minimum opening
Min_Ext_Damper	Fresh air damper minimum opening
Req_enth	Enthalpy request

In the case of freecooling by enthalpy, the control request will depend on the deviation from the control set point. Control for freeheating by enthalpy is similar.



Key	
Req_enth	Control request
diff_enth	Enthalpy control differential
Set_enth	Enthalpy set point

8.9 Heat recovery

8.9.1 Definition

If the AHU is fitted with a heat recovery unit, the heat contained in the exhaust air is recovered and transferred to the primary air so as to preheat or precool it, if the conditions are favourable: **consequently freecooling/freeheating and heat recovery are mutually exclusive.** When the AHU is in heat recovery mode, the bypass damper on the heat recovery unit is closed.

In cascade control the request is shared between the various devices available. Heat recovery is thus considered a free source of energy free, activated with priority in cascade control in cooling and heating modes.

8.9.2 Enabling

The heat recovery function can only be enabled if a heat recovery unit is installed and enabled. The bypass damper (Ha01) may not be necessary. Below is a list of possible combinations.

Ha14	**Type of heat recovery**			
Bypass damper	Cross flow	Run-around coil	Modulating rotary	On/Off rotary
No	YES	YES	YES	YES
On/Off	YES	YES	YES	YES
Modulating	YES	YES	NO	YES

ON/OFF DEVICES		
Screen index	**Display description**	**Enable**
Hb39	Heat recovery unit pump (run-around coil)	Position ≠ 0
	Heat wheel (ON/OFF)	Position ≠ 0
	Bypass damper (ON/OFF)	Position ≠ 0

MODULATING DEVICES		
Hb63	Heat wheel	Position ≠ 0
Hb56	Bypass damper (ON/OFF)	Position ≠ 0

8.9.3 Types of heat recovery unit

Cross-flow heat recovery unit: no dedicated output.

Run-around coil heat recovery unit: only one digital output is activated, which starts the pump. If the bypass damper has On/Off operation, activation of the pump will be the reverse to the damper. With modulating dampers, the pump will remain on while heat can be recovered and the bypass damper will modulate the quantity of heat recovered, depending on the request.

Modulating heat wheel: an analogue output is managed for modulation of wheel rotation speed and an On/Off output for the bypass damper. The heat recovery request acts directly on the wheel speed, which may have a minimum limit set. The bypass damper will be activated when no heat can be recovered.

On/Off heat wheel: an on/off output is managed to control the heat recovery unit. The bypass damper will be activated when no heat can be recovered.

Mask index	**Display description**	**Selection**
Ha14	Heat recovery type	1: None ¦ 2: Plate exchanger ¦3: Run-around coil ¦ 4: Modulating rotary ¦ 5: On/Off rotary

Note: with on/off or modulating heat wheels, heat can also be recovered by controlling the enthalpy conditions.

The function has two stages:

1) check whether the return temperature or enthalpy conditions are favourable compared to the outside air conditions;

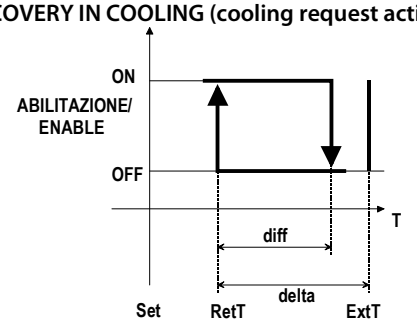
2) the request of summer/winter acts on the speed of the heat wheel or on the modulating bypass damper.

8.9.4 Activation

Note: the following graphs consider the outside temperature to be constant.

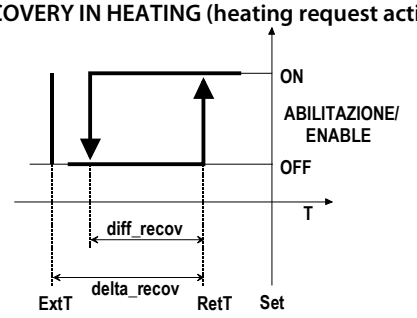
Heat recovery is activated when the return temperature is closer to the temperature set point than the outside temperature.

RECOVERY IN COOLING (cooling request active)



ON: ExtT-RetT> delta_recov; OFF: ExtT-RetT< delta_recov – diff_recov

RECOVERY IN HEATING (heating request active)



ON: RetT-ExtT-> delta_recov; OFF: RetT-ExtT < delta_recov – diff_recov

Key			
diff_recov	Recovery differential	Set	Set point
RetT	Return temperature	delta_recov	Recovery delta
ExtT	Outside temperature		

Mask index	**Display description**	**Def**	**Min**	**Max**	**UOM**
Gfc31	Heat recovery temperature activation				
	Delta recovery	5	0	99.9	°C
	Differential	3	0	99.9	°C

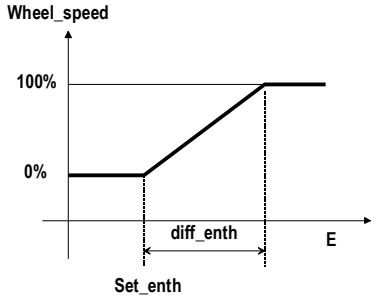
Note: for heat recovery by enthalpy, only applicable to the wheel, the same rules apply for activation. The enthalpy delta is fixed at 4 kJ/kg and the differential is fixed at 2 kJ/kg.

Based on the efficiency of the heat recovery unit, a deviation (delta) must be set between the return and outside temperature. The more efficient the heat recovery unit, the lower the delta. The differential (diff_recov) is used to switch off the devices in advance, so as to reduce energy consumption, above all relating to operation of the heat wheel or pump for the run-around coil heat recovery unit. For heat recovery units consisting of a plate heat exchanger, on the other hand, flow through the heat exchanger increases pressure drop and consequently fan power consumption.

8.9.5 Control

Control by temperature depends on the set point and the temperature differentials, based on the percentage of request reserved for the heat recovery unit. See the paragraph "Cascade control".

As regards control by enthalpy, the control differential needs to be set, based on which the heat wheel rotation speed will vary. For run-around coil heat recovery units, the pump will be on or off according to the activation graphs shown in the previous paragraph.



Key

Wheel_speed	Heat wheel speed
diff_enth	Enthalpy control differential
Set_enth	Enthalpy set point
E	Enthalpy

Mask index	Display description	Def	Min	Max	UOM
Gfc31	Enthalpy regulation				
	Differential	5	0	99.9	kJ/kg

8.9.6 Heat recovery unit frost protection function

The heat recovery unit frost protection function prevents problems due to frost forming on the heat recovery unit. The actions undertaken depend on the type of heat recovery unit: in any case, the bypass damper is fully open. Given that the exhaust air has a defrosting effect:

• the run-around coil heat recovery unit pump continues operating;
• the heat wheel continues operating.

8.9.7 Activation and control

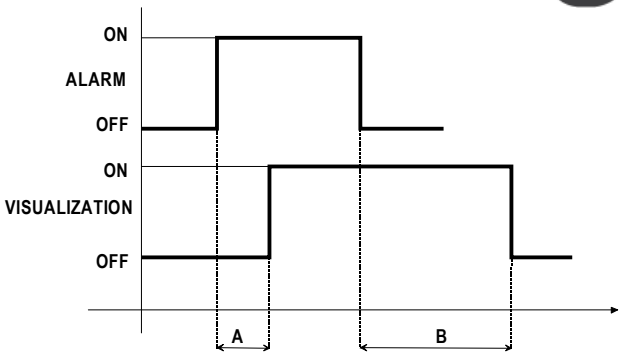
To enable the function, define the probe that measures the temperature, enable (optional) a defrost heater and define the activation set point and differential. For modulating heat wheels, the speed during frost protection can also be selected.

Mask index	Display description	Selection
Ha14	Heat recovery type	
	…	
	Defrost probe	None ¦ External-Return (*) ¦ Exhaust ¦ External
	Recovery heater	No ¦ Yes
Hb41	Heater heat recovery unit	Position ≠ 0

(*)Arithmetic average between the 2 probes.

Mask index	Display description	Def	Min	Max	UOM
Gfc32	Heat recovery defrost				
	Setpoint	-1	-99.9	10	°C
	Differential	4	0	99.9	°C
	Heater offset	3	0	99.9	°C
	Wheel min speed	100	0	100	%
Hc18	Heat recovery				
	Defrost delay				
	Start	120	0	999	s
	End	60	0	999	s
	Clogged alarm delay	60	0	300	s

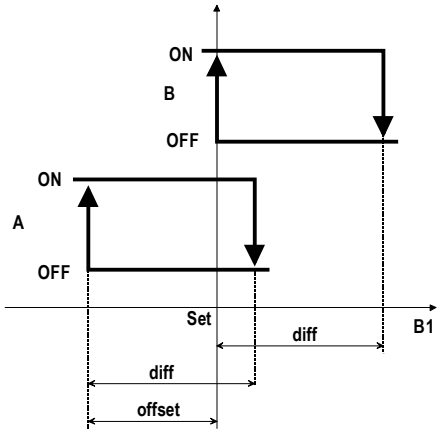
Once the heat recovery unit frost protection alarm is activated, for example when the frost protection thermostat contact closes, a delay from the start of the signal and a delay from the end of the signal can be set.



Key

A	Start	B	End

Below is a graph showing activation of the damper and frost protection heater, based on the defrost probe reading.



Key

A	Heat recovery unit frost protection heater	Set	Set point
B	Bypass damper	offset	Offset
B1	Defrost probe	diff	Differential

8.10 Cascade control

The cooling request and heating request can be shared between freecooling/freeheating and the coil, and between the heat recovery unit and the coil.

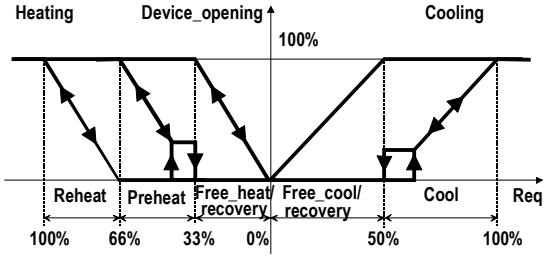
Mask index	Display description	Def	Min	Max	UOM
Gfc20	Cooling cascade				
	Freecooling	50	0	100	%
	Coil	50	0	100	%
	Recovery	40	0	100	%
	Coil	40	0	100	%
Gfc21	Heating cascade				
	Freeheating	50	0	100	%
	Coil	50	0	100	%
	Recovery	40	0	100	%
	Coil	40	0	100	%

As regards heating, the heating request can be further shared between the preheating and reheating coils.

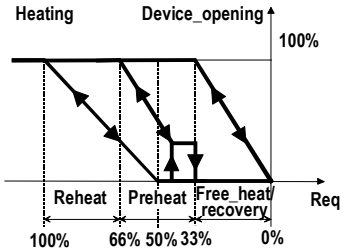
Note: overlapping operation of the preheating and reheating coils is also possible.

Mask index	Display description	Def	Min	Max	UOM
Gfc22	Heating cascade				
	Reheating	80	%	0	100

Example 1: partition of request between devices.



Example 2: overlapping of preheating and reheating coils.



Key

Recovery	Recovery	Req	Request
Free_heat	Freeheating	Device_opening	Device activation
Preheat	Preheating coil valve	Reheat	Reheating coil valve

8.11 Supply limits

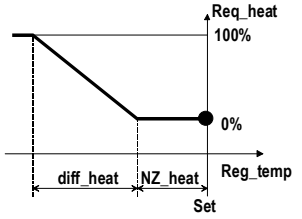
8.11.1 Definition

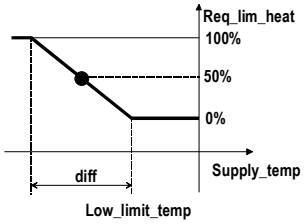
Note: the supply limits function can be activated (Gfc04) only if the control probe is the return probe or room probe .

The algorithm is used to correct the action of the main control function to return within acceptable values for the supply temperature. For example, if the fresh air damper opens to satisfy a air quality request, this attenuates the request on the actuators (e.g. heating coil, humidifier) so as to mitigate the effect on the supply temperature and humidity. Without this function, the supply air may cause discomfort (e.g. too hot or too cold) near the air inlets. The function can be activated on either the minimum or maximum temperature or humidity. There are two possible cases: action concordant with or contrasting against control.

8.11.2 Temperature limits with concordant action

Example of operation in heating mode (winter): when the control set point is reached and the heating coil stops heating, an air quality request causes the fresh air damper to open and consequently the air supply temperature decreases. To prevent the temperature measured by the control probe from changing further, when the air supply temperature is less than minimum allowed limit the heating coil is activated, with proportional or PI control, according to the following graph, where the total request is 50%.



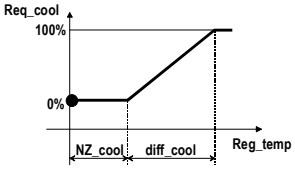


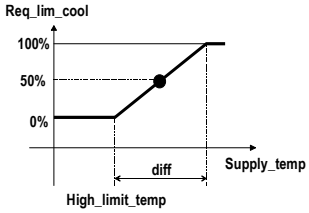
0% + **50%** = **50%**

Key

Req_lim_heat	Additional heating request	Reg_temp	Control probe temperature
NZ_heat	Neutral zone in heating	Supply_temp	Supply probe temperature
Diff_heat	Heating differential	Diff	Supply limit differential

The behaviour is similar in cooling mode (summer).





0% + **50%** = **50%**

Key

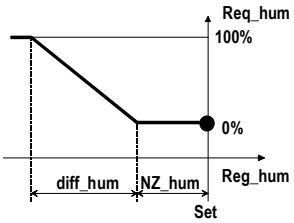
Req_lim_cool	Additional cooling request	Reg_temp	Control probe temperature
NZ_cool	Neutral zone in cooling	Supply_temp	Supply probe temperature
Diff_cool	Cooling differential	Diff	Supply limit differential
High_limit_temp	High temperature limit		

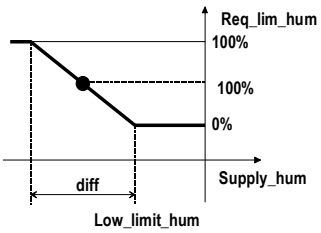
Mask index	Display description	Selection
Gfc04	Temperature regulation	
	Auto cool/heat	No ¦ Yes
	Supply limits	None ¦ High ¦ Low ¦ High/low

Mask index	Display description	Def	Min	Max	UOM
Gfc07	Temperature supply limits				
	Summer high	40	-99.9	99.9	°C
	Winter high	40	-99.9	99.9	°C
	Summer low	10	-99.9	99.9	°C
	Winter low	10	-99.9	99.9	°C
	Differential	3	0	99.9	°C
	Integral time	150	0	999	s

8.11.3 Humidity limits with concordant action

Example of operation in humidification mode: when the control set point is reached and humidification ends, an air quality request causes the fresh air damper to open and consequently the supply humidity may decrease. To prevent the humidity measured by the control probe from changing further, when the supply air humidity is less than minimum allowed limit, the humidifier is activated, with proportional or PI control, according to the following graph, where the total request is 50%.



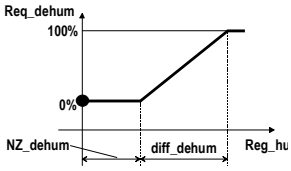


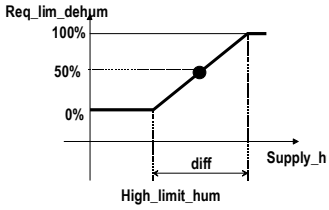
0% + **50%** = **50%**

Key

Req_lim_hum	Additional humidification request	Reg_hum	Control probe humidity
NZ_hum	Neutral zone in humidification	Supply_hum	Supply probe humidity
Diff_hum	Humidification differential	Diff	Supply limit differential
Low_limit_hum	Low humidity limit		

The behaviour is similar in dehumidification mode.





0% + 50% = 50%

Key

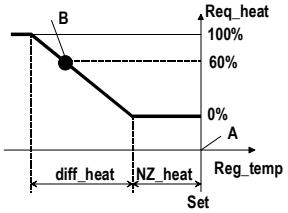
Req_lim_dehum	Dehumidification request for limit	Reg_hum	Control probe humidity
NZ_dehum	Neutral zone in dehumidification	Supply_hum	Supply probe humidity
Diff_dehum	Dehumidification differential	Diff	Supply limit differential
High_limit_hum	High humidity limit		

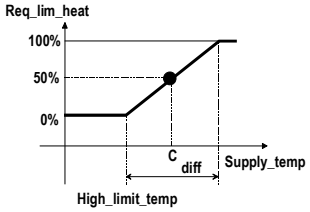
Mask index	Display description	Selection
Gfc10	Humidity regulation	
	Auto hum/dehum	No ¦ Yes
	Supply limits	None ¦ High ¦ Low ¦ High/low

Mask index	Display description	Def	Min	Max	UOM
Gfc13	Humidity supply limits				
	High limit	100	0	100	% RH
	Low limit	0	0	100	% RH
	Differential	4	0	100	% RH
	Integral time	150	0	999	s

8.11.4 Temperature/humidity limits with contrasting action

Example of operation in heating mode (winter): the temperature measured by the control probe moves away from the set point (A) and reaches point B; the heating coil is then activated at 60%. If the temperature measured by the supply probe reaches point C, a control function is activated that limits the request signalled to the heating coil to 10% (60%-50%).





60% - 50% = 10%

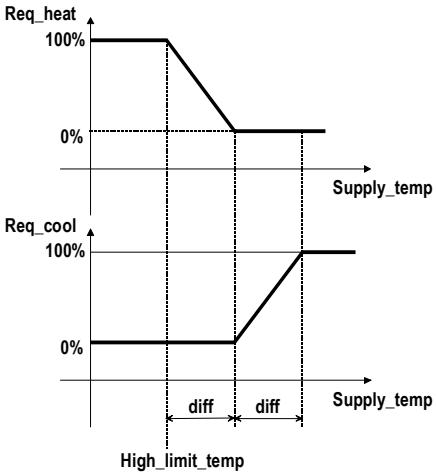
Key

Req_lim_heat	Heating request for limit	Reg_temp	Control probe temperature
NZ_heat	Neutral zone in heating	Supply_temp	Supply probe temperature
Diff_heat	Heating differential	Diff	Supply limit differential

If double action is enabled, the action of the heating device will be limited until complete deactivation after the differential, when the cooling device will be activated.

The function is similar in:
1) cooling;
2) humidification;

Mask index	Display description	Selection
Gfc07	Temperature supply limits	
	Enable double action	No ¦ Yes



Key

Req_heat	Heating request	Reg_temp	Control probe temperature
Diff	Supply limit differential	Supply_temp	Supply probe temperature
High_limit_temp	High temperature limit		

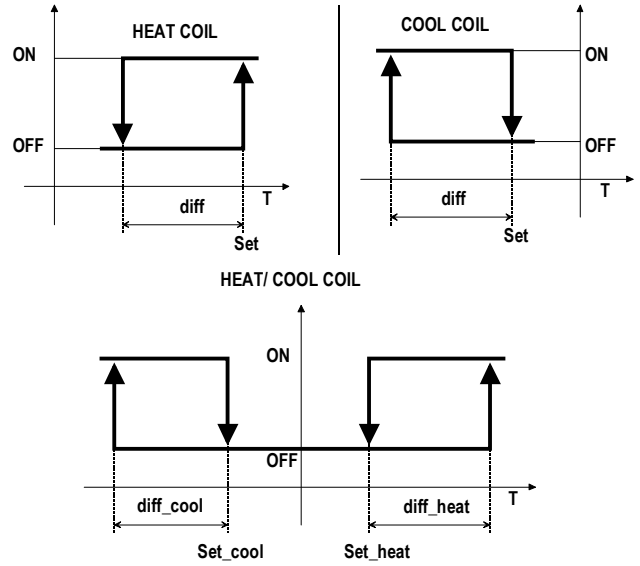
Note: the limiting action acts on the request signal. Therefore, the devices involved depend on the cascade control function described in point 8.10. For example, on an AHU in heating operation with auto mode enabled, in summer may operate with freecooling only: the supply limit is thus applied to avoid letting in outside air that is too cold.

8.12 Coils water temperature limits

To avoid opening of valves on the coils when the water temperature has not exceeded a minimum limit, the "Coil temperature limits" function can be enabled, available for every type of coil with its own set point and differential.

Mask index	Display description	Selection
Hc09	Enable preheating coil water temperature threshold	0:No¦ 1:Yes
Hc11	Enable cooling coil water temperature threshold	0:No¦ 1:Yes
Hc14	Enable heat/cool coil water temperature threshold	0:No¦ 1:Yes
Hc16	Enable reheating coil water temperature threshold	0:No¦ 1:Yes

Mask index	Display description	Def	Min	Max	UOM
Hc09	Enable preheating coil water temperature threshold				
	Threshold	25	-99.9	99.9	°C
	Differential	2	0	99.9	°C
Hc11	Enable cooling coil water temperature threshold				
	Threshold	35	-99.9	99.9	°C
	Differential	2	0	9.9	°C
Hc14	Enable heat/cool coil water temperature threshold				
	Hot threshold	25	-99.9	99.9	°C
	Cool threshold	35	-99.9	99.9	°C
	Differential	2	0	9.9	°C
Hc16	Enable reheating coil water temperature threshold				
	Threshold	25	-99.9	99.9	°C
	Differential	2	0	99.9	°C



Note: when season changeover is enabled based on the water temperature, the heating/cooling coil temperature limit is set on Hb16 and the switching threshold on Gc03.

Mask index	Display description	Selection
Gc01	Season selection from	H_2O temperature

Mask index	Display description	Def	Min	Max	UOM
Gc03	Season threshold				
	Summer	25	-99.9	99.9	°C

8.13 Pump management

Up to two pumps are managed, with rotation and alarms. The corresponding functions concern:

1) automatic rotation between the pumps to equally share the work load and operating hours between pumps. This is activated:
• when a certain period of time expires;
• when a thermal overload alarm is activated or there is no flow on one of the two pumps;
2) antiblock management, with temporary activation of the pump when the system is not used for long periods;
3) frost protection by starting the pump to circulate fluid.

The pumps are enabled as devices and consequently the number needs to be defined. For the explanations of the other parameters, see "Rotation between two pumps" and "Pump alarms".

Mask index	Display description	Selection
Ha09	Enable water pumps Cooling-Cool/heat	0:No¦ 1:Yes
	Preheating	0:No¦ 1:Yes
	Reheating	0:No¦ 1:Yes
	Enable flow feedback	0:No¦ 1:Yes

Mask index	Display description	Def	Min	Max	U.M
Ha10	Cooling – cool/ heat pumps				
	Number of pumps	2	1	2	-
	Warning limit	3	0	5	-
	Enable antiblock	Yes	0	1	-
Ha11	Preheating pumps				
	Number of pumps	2	1	2	-
	Warning limit	3	0	5	-
	Enable antiblock	Yes	0	1	-
Ha12	Reheating pumps				
	Number of pumps	2	1	2	-
	Warning limit	3	0	5	-
	Enable antiblock	Yes	0	1	-
Hc17	Pumps				
	Alarm flow delay	30	1	999	s
	Start	15	1	999	s
	Pumps rotation time	96	0	999	hour
	Overwork time	0	0	999	s

8.13.1 Rotation between two pumps

When one pump has operated for the time defined by "Rotation time", operation of the pumps is rotated. "Overlapping time" can be used to manage the changeover sequence between pumps:

OVERLAPPING TIME		
>0	=0	<0
Active pump stop delay	Pump ON stops and pump OFF starts	Pump OFF start delay (*)

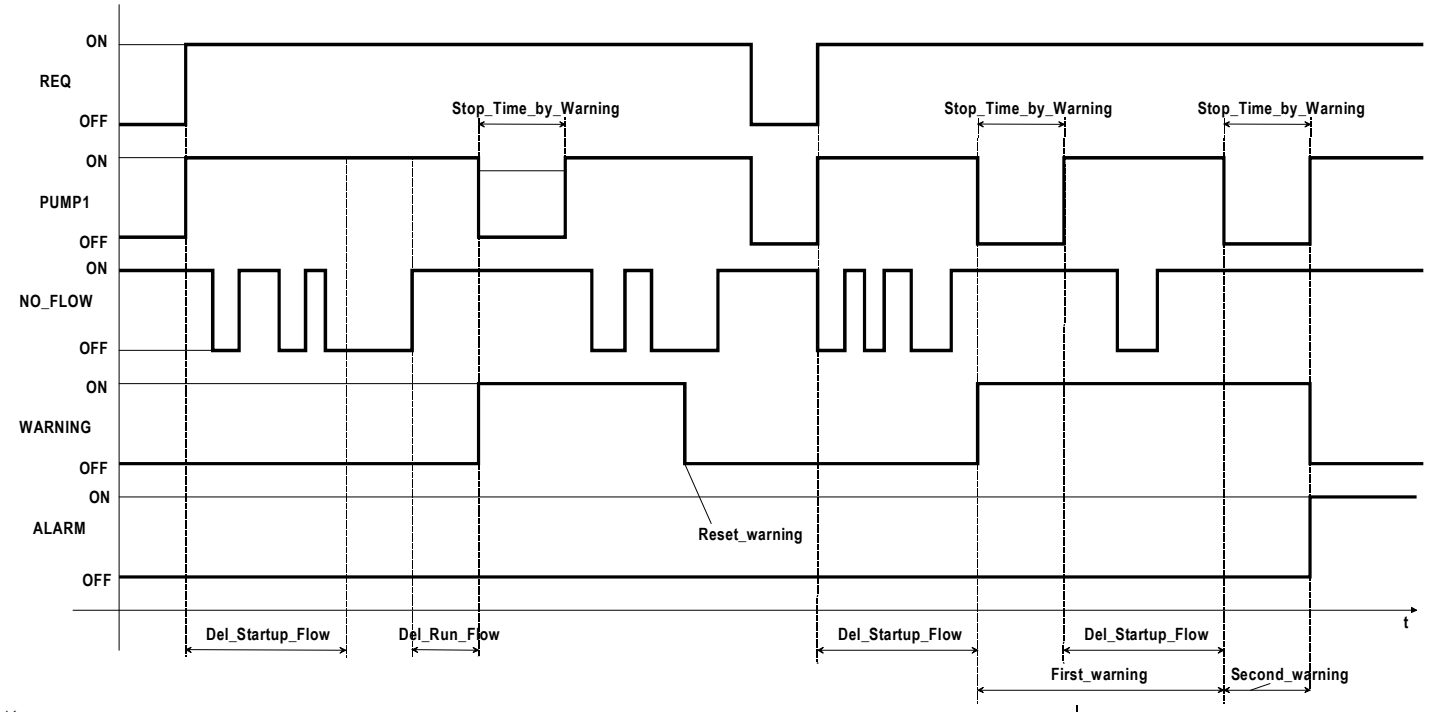
(*) During the overlapping time no pump is on.

8.13.2 Pump alarms

There are two types of alarm:
• in the event of overload alarms, the alarm is signalled and the pump stops immediately. If a second pump is available operation is rotated;
• in the event of flow alarms, a warning signal is sent until the pump stops completely. If a second pump is available operation is rotated. Each pump sends a number of malfunction signals equal to the "Warning limit" before the no flow alarm is activated. This alarm has a delay from when absence of flow is measured, and differs depending on whether the pump is starting or is in steady operation.
In the following example the alarm is activated after two warnings.

Note:
• the number of warnings is reset as soon as water flow is measured and is automatic;
• the warning remains active during the attempts to restore pump flow;
• as soon as the alarm is activated the warning is automatically reset;
• when there is an active warning, the pump stays off for a set time. Only after this time interval can the pump start again, repeating the start-up procedure: the warning is reset only flow is measured and the pump is on;
• if the number of attempts to restore flow is 0, the alarm is activated immediately and no attempt is performed to restore flow;
• also see the documents on pump module in 1tool.

EXAMPLE

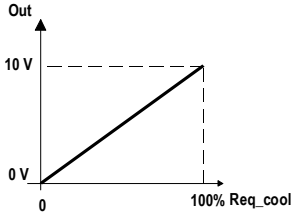


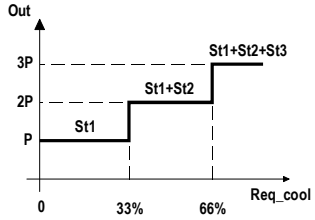
Key				
REQ	Request	Del_Startup_flow	Flow alarm delay in start-up	
PUMP1	Pump	Del_Run_Flow	Flow alarm delay in steady operation	
ALARM	Alarm			

8.14 Cooling devices

The following cooling devices are managed (Ha06):

- valves: 0 to 10 V with one analogue output
- floating valves, with two relays outputs, one for the open command and one for closing;
- direct expansion: stepped control, calling the condenser only without management of the refrigeration cycle.





Key			
Req_cool	Cooling request	St1 to 3	Step 1 to 3
P	Capacity		

Note: the total cooling request is divided between the various cascade control devices, based on the PID control parameters, and is affected by the supply limits.

8.15 Heating devices

The following heating devices are managed (Ha05, Ha08):

- valves: 0 to 10 V with one analogue output
- floating valves, with two relays outputs, one for the open command and one for closing;
- heaters.

Note: the total heating request is divided between the various cascade control devices, based on the PID control parameters, and is affected by the supply limits.

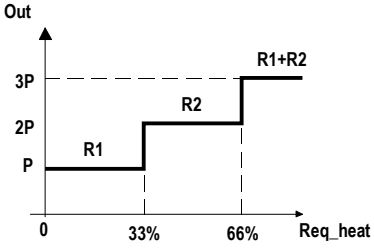
The heaters may be on/off or modulating, for the selection see parameter Ha05.

Mask index	Display description	Selection
Ha05	Heaters type	On/Off ¦ Modulating ¦ On/Off binary

The type of control depends on the number of heaters:
1) Modulating: see the graph in the previous paragraph;
1) ON/OFF;
2) ON/OFF binary (for 2 heaters only): if the heaters are suitably sized (R1 with power P and R2 with power 2P) the controller can deliver capacity in steps from 0 to 3P (figure).

PREHEATING HEATERS	
Type	ON/OFF, Modulating, ON/OFF binary

ON/OFF BINARY CONTROL FOR 2 HEATERS

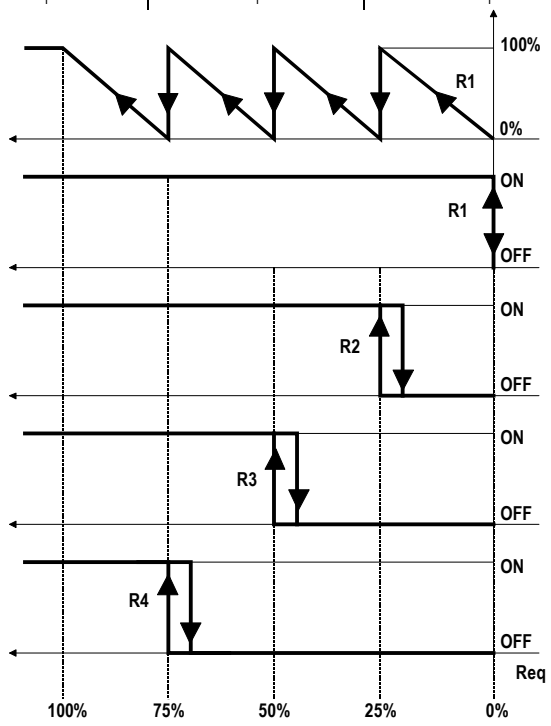


Key			
P	Power	R1,2	Heater 1, 2
Req_heat	Heating request		

If control is modulating and there is one heater, this will be controlled by a digital output plus 1 analogue output for modulation, while if there are from 2 to 4 heaters (with the same power rating) modulation will only be applied to one heater (1 digital output + 1 analogue output) and the remaining heaters will be controlled by digital outputs only.

OUTPUTS FOR MODULATING HEATER CONTROL

NO. OF HEATERS	DIGITAL OUTPUTS	ANALOGUE OUTPUTS
1	1	1
2	2	1
3	3	1
4	4	1



Key

Req	Request	R1 to R4	Heater 1 to 4

8.16 Cooling devices

The following cooling devices are managed (Ha06):

- valves: 0 to 10 V with one analogue output
- floating valves, with two relays outputs, one for the open command and one for closing;
- direct expansion: stepped control, calling the condenser only without management of the refrigeration cycle.

Note: the total cooling request is divided between the various cascade control devices, based on the PID control parameters, and is affected by the supply limits.

TYPE OF FAN CONTROL

Selection	Type of control	Outputs envisaged (*)	
		DIG	AN
Inverter	Air quality Static pressure	1	1
On-off (double)	Two fans installed in parallel to modify the ventilating section. Same control as direct starting with delay set between the two	2	-
On-off (star – delta)	Same as direct starting with setting of contactor digital outputs	3	-
On-off (direct starting)	Fan start-up linked only to unit power-on	1	-
On-off (backup fan)	Pair of fans where one is the backup for the other in the event of faults (flow, thermal overload alarm)	2	-
On-off (2 speed)	Speed 1: Unit ON; 2: Air quality request	2	-

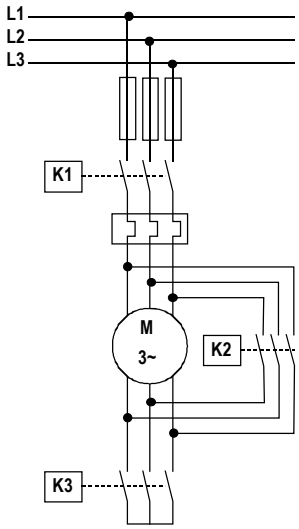
(*) if only supply fan fitted. Double the number of outputs with supply and return air fans.

8.16.1 On/Off fans with direct and star-delta starting

The fans are started when the unit is powered up. For starting, as well as the fan outputs, the outputs for the 3 contactors also need to be enabled (see the figure)

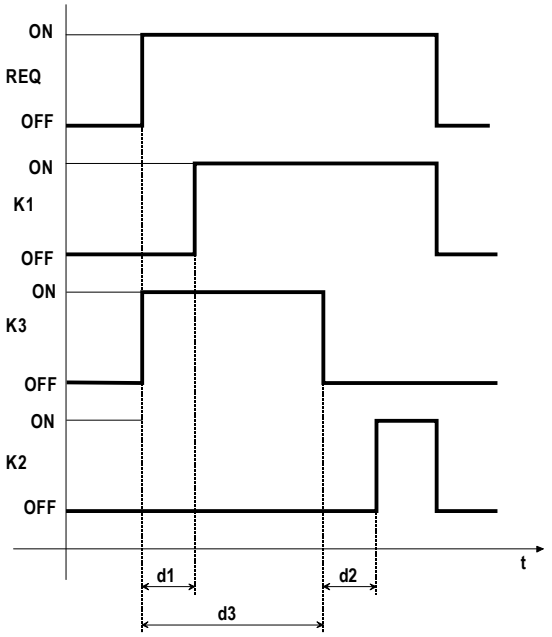
1) Supply/return air fan line (K1)
2) Supply/return air fan star (K3);
3) Supply/return air fan delta (K2)

The switching delay time also needs to be set.



Mask index	Display description	Selection
Ha03	Fan type	1: On-Off(direct start) ¦ 2: On-Off(star-delta) ¦ 3: On-Off (double) ¦ 4: Inverter ¦ 5: On-Off(2 speed) ¦ 6: On-Off (duty standby) ¦
Hb37	Star-delta logic	
	Supply fan line	position ≠0
	Supply fan star	position ≠0
	Supply fan delta	position ≠0
Hb37	Return fan line	position ≠0
	Return fan star	position ≠0
	Return fan delta	position ≠0

Mask index	Display description	Def	Min	Max	UOM
Hc04	Fans Star-Delta timing				
	Star-line	-	0	99	ms
	Star	-	0	99	ms
	Star-delta	-	0	99	ms



Key

REQ	Fan request		
K1	Fan line	K2	Fan delta
K3	Fan star	d1	Line – star delay
d2	Star-delta delay	d3	Star time

8.16.2 Double On/Off fans

This is when there are two fans fitted in parallel, to modify the ventilating section. Activation again depends on unit power-on, however a delay is available between activation of the first and second fan (supply – return).

Mask index	Display description	Def	Min	Max	UOM
Hc06	Fans timing				
	Stop delay	30	0	999	s
	Supply-return	0	0	999	s

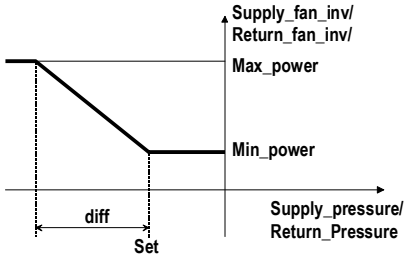
8.16.3 Fans with inverters

If the fans are controlled by inverter, three types of control can be selected:

Mask index	Display description	Selection
Ha03	Fan type	1: Static pressure ¦ 2: Air quality ¦ 3: Fixed speed

1) Static pressure: on unit power-up the fan operates at minimum speed and then tries to reach the differential pressure set point, with the PID parameters set.

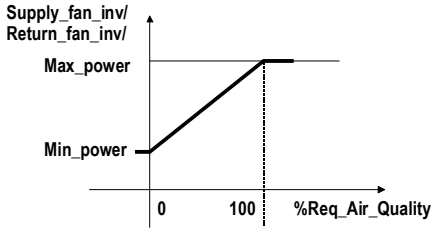
Mask index	Display description	Def	Min	Max	UOM
Gfc17	Supply inverter				
	Minimum/fixed power	30	0	100	%
	Max power	100	0	100	%
	Return inverter				%
	Minimum/fixed power	30	0	100	%
	Max power	100	0	100	%
Gfc18	Supply flow control				
	Setpoint	1500	0	2000	Pa
	Differential	300	0	1000	Pa
	Integral time	300	0	1000	s
	Derivative time	10	0	9999	s
Gfc19	Return flow control				
	Setpoint	1500	0	2000	Pa
	Differential	300	0	1000	Pa
	Integral time	300	0	1000	s
	Derivative time	10	0	9999	s



Key

Supply_pressure/ return pressure	Supply/ return pressure
Supply_fan_inv/ Return_fan_inv	Supply / return fan inverter request
Min_power	Minimum power
Max_power	Maximum power

2) Air quality: on unit power-up the fan tries to satisfy the request.



3) Fixed speed: control is completely disabled and the fan operates at a fixed speed.

Mask index	Display description	Def	Min	Max	UOM
Gfc17	Supply inverter				
	Minimum/fixed power	30	0	100	%
	Return inverter				%
	Minimum/fixed power	30	0	100	%

8.16.4 On/Off fans with backup

This configuration features a pair of fans, where one is backup for the other in the event of flow or excess temperature alarms. If activated (Ha04), there are two overload alarms for the supply fans and two for the return fans. The flow alarm, on the other hand, uses one device (pressure switch/flow switch or differential probe) for the supply fans and one device for the return fans. A rotation time can be set between the two fans and backup fan activation can be brought forward/delayed by setting the overlapping time >/<0.

Mask index	Display description	Def	Min	Max	UOM
Hc06	Fans timing				
	Stop delay	30	0	999	s
	Supply-return	0	0	999	s
	Rotation time	0	0	999	h
	Overworking time	0	-99	99	s

8.16.5 Two speed fans

In this case a two-speed fan can be installed, where the first is activated when the unit starts (supply/return air fan 1) and the second is activated due to an air quality request (supply/return air fan 2).

Mask index	Display description	Selection
Hb35	Supply fan	
	Position	≠0
	Logic	NC, NO
Hb36	Supply fan 2	
	Position	≠0
	Logic	NC, NO

If activated (Ha04), one thermal overload alarm is available for the supply fan and one thermal overload alarm for the return fan.

8.16.6 Fan alarms

The alarms due to excess temperature or no flow are enabled on screen Ha04. The thermal overload alarm is only signalled via a digital input, connected for example to a suitably calibrated thermostat. The flow alarm can be generated by a pressure switch/flow switch or by a differential pressure probe.

Mask index	Display description	Selection
Ha04	Fan alarms	
	Overload	1: None ¦ 2: Supply ¦ 3: Supply + return
	Air flow	1: None ¦ 2: Supply ¦ 3: Supply + return
	Air flow from	0: Pressure switch ¦ 1: Transducer
	Stop action	0: Individual ¦ 1: All
Hb27	Supply flow control	
	Position	≠0
	Logic	NC, NO
	Return flow control	
	Position	Position
	Logic	Logic
Hb09	Supply pressure position	
	Position	
	Type	4 to 20 mA ¦ 0 to 1 V ¦ 0 to 10 V
	Min limit	
	Max limit	
Hb09	Return pressure position	
	Position	
	Type	4 to 20 mA ¦ 0 to 1 V ¦ 0 to 10 V
	Min limit	
	Max limit	

Note: if the alarms involve the supply fan (Ha04), the control devices that are stopped are those on the supply.

A delay when starting and a delay in steady operation can be set for the flow alarm. The alarm has automatic reset until reaching the set number of attempts and subsequently has manual reset. The flow alarm stops the fan for a certain fixed time before attempting to start it again. In the case of backup fans, the second fan will be activated immediately, if available.

Mask index	Display description	Def	Min	Max	UOM
Hc05	Flow alarm threshold				
	Supply	100	0	9999	Pa
	Return	100	0	9999	Pa
	Differential	300	0	9999	Pa
Hc07	Fans flow alarm				
	Start-up delay	20	1	999	s
	Running delay	5	1	999	s
	Flow warning retries	0	0	5	-

8.17 Air quality

8.17.1 Definition

CO2 and/or VOC (Volatile Organic Compound) probes can be used to monitor air quality and if necessary increase the flow-rate of fresh air to increase the concentration of oxygen.

8.17.2 Enabling

The air quality control function can only be enabled if the mixing damper is fitted or the fan features modulating operation. The type of control can be selected between proportional or proportional+integral.

Mask index	Display description	Selection
Ha02	Dampers type	Fresh air+mixing ¦ Fresh air+mixing+exhaust
	Enable air quality management	Yes
Ha03	Fan type	inverter
	Fan regulation	Air quality
Ha15	Air quality	
	Regulation type	Proportional ¦ P+I
	Air quality: Probe type	CO2 ¦ CO2+VOC ¦ VOC
Hb13	CO2 air quality	Position ≠ 0
Hb14	VOC air quality	Position ≠ 0

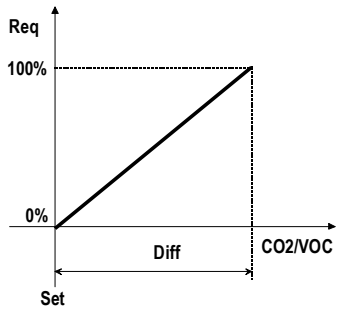
Note:

- if both probes (CO2+VOC) are set, the active request will be the higher of the two;
- setting fan control to air quality automatically enables the function. With other settings, to enable quality control, set the corresponding parameter on Ha02.

8.17.3 Control

Once the type of probe has been selected, the set point and differential need to be defined for each function. For P+I control, also set the integral time.

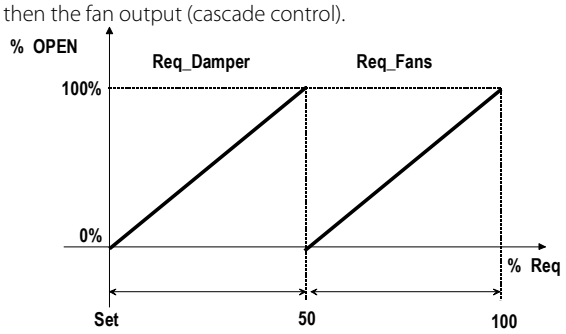
Mask index	Display description	Def	Min	Max	UOM
Gfc30	Air quality with CO2				
	Setpoint	1200	0	5000	ppm
	Differential	200	0	5000	°C
	Air quality with VOC				
	Setpoint	50	0	100	%
	Differential	10	0	100	%
Hc19	Integral time	300	9999		s



Key

CO2/VOC	CO2/VOC probe	Req	Air quality request
Set	CO2/VOC air quality set point		
Diff	CO2/VOC air quality differential		

Based on the request, first the fresh air damper output will be increased and then the fan output (cascade control).

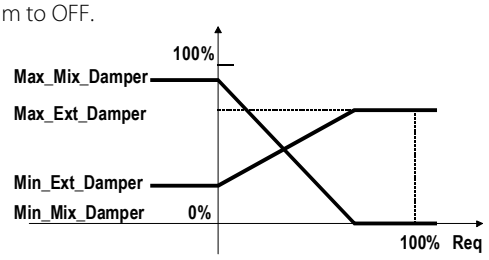


Key

Set	Air quality set point
Req_Fans	Fan request
Req_Damper	Fresh air damper request
Req	Air quality request

Note: the fan request from 0 to 100 % varies the fan speed between minimum and maximum.

The maximum and minimum limits for the mixing and fresh air dampers are set on Hc02. Based on the percentage of the air quality request, the dampers will operate with the following trend. The exhaust damper, if available, follows the trend of the fresh air damper. For ON/OFF dampers, maximum corresponds to ON and minimum to OFF.



Key

Req	Air quality request
Min_Mix_Damper	Mixing damper minimum limit
Max_Mix_Damper	Mixing damper maximum limit
Min_Ext_Damper	Fresh air damper minimum limit
Max_Ext_Damper	Fresh air damper minimum limit

Note: opening the fresh air damper involves proportionally closing the mixing damper, respecting the corresponding minimum and maximum limits. If a freecooling/freeheating request is also active, the fresh air damper will open based on the higher of the two.

8.18 Purging

8.18.1 Definition

Air purging, once enabled, manually forces fresh air into the room for a set time.

8.18.2 Enabling

The following are possible:
1) enable the purge function manually only if the mixing damper is installed and the function is enabled;
2) automatically activate the function at start-up (based on the scheduler).

Mask index	Display description	Selection
Ha15	Enable purging	0: No ¦ 1: Yes
Gg02	Air quality	
	Start purging	No ¦ Yes
	Stop purging	No ¦ Yes
	Resume time	---min
	Repeat at start-up	No ¦ Yes

Mask index	Display description	Def	Min	Max	UOM
Hc19	Cleaning time	10	0	300	min

8.18.3 Control

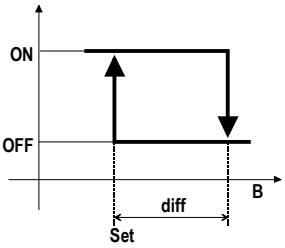
During the purge function, the fresh air damper is fully opened to assist the inlet of fresh air and the fan is operated at maximum speed.

Note: in the status of frost protection the function is disabled.

8.19 Frost protection

8.19.1 Unit frost protection

This can be activated by thermostat, probe or thermostat and probe together. If activated by thermostat, the "Frost protection alarm" digital input is configured on Hb25, if activated by probe the frost protection probe analogue input is configured on Hb11; the set point and differential are set on Gfc33.



Key

Set	Frost protection set point	B	Frost protection probe
diff	Frost protection differential		

Mask index	Display description	Selection
Ha16	Frost protection	1: none ¦ 2: by frost-stat ¦ 3: by probe ¦ 4: by probe+frost-stat
Hb11	Frost temperature position	position ≠0
		type: NTC ¦ PT1000
Hb25	Frost-stat	position ≠0

Mask index	Display description	Def	Min	Max	UOM
Gfc33	Frost temperature position				
	Setpoint	5	-99.9	99.9	°C
	Differential	3	0	99.9	°C

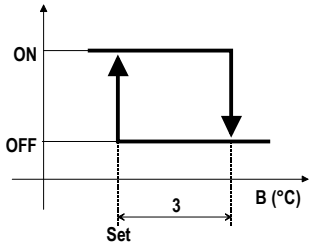
If the frost protection probe measures a temperature less than Set+diff, the controller activates "Frost protection prevention" mode, with the icon shown on the display: the preheating coil capacity is increased gradually. The fresh air damper is closed gradually however only if the mixing damper is installed. The controller exits "frost protection prevention" mode when the temperature exceeds Set+diff.

If, on the other hand, the temperature continues falling and the frost protection probe value is less than Set, the frost protection alarm is activated, with automatic reset. The display continues showing the icon. The controller:
1) stops the fans;
2) closes the dampers;
3) activates the preheating coil at 100%;
4) activates the cooling coil at 50%;
5) activates all the pumps.
If, as a consequence of these actions, the frost protection probe measures a temperature greater than Set+diff, the controller exits frost protection mode.

Note:
• unit frost protection is also active when the unit is OFF;
• frost protection by thermostat only features the alarm with automatic reset;
• for alarms from probe +thermostat, use the thermostat as a safety device and calibrate it to lower temperature than the frost protection set point.

8.19.2 Room frost protection

The room probe must be enabled on Hb04. The set point is then set on Gfc34. The differential is fixed at 3°C.



Key

Set	Room frost protection set point	B	Room probe

Mask index	Display description	Selection
Hb04	Room temperature	Position ≠ 0
Gfc34	Room frost protection enable	No ¦ Yes

Mask index	Display description	Def	Min	Max	UOM
Gfc34	Setpoint	5	-99.9	99.9	°C

If the room temperature is less than the set point and the controller is OFF:
a) the display shows frost protection as being active;
b) the controller starts operating as if it were ON, based on the control probe reading

8.20 Auxiliary control

Four auxiliary control loops can be enabled, each with its probe, P, PI or PID control and activation. The set points, differentials and integral times can be displayed on screens B11 to B14.

Mask index	Display description	Selection
Ha19	Auxiliary regulation loop	None, 1 to 4
Ha20 to Ha23	Regulation loop 1	
	Regulation type	Direct ¦ inverse
	Output type	Modulating +on/off ¦ on/off ¦ modulating
	Other management	None ¦ on with supply fan ¦ Force with frost protection
Hb19 to 22	Regulation probe loop 1 to 4	
	Position	≠0
	Type	NTC ¦ PT1000 ¦ 0 to 1 V ¦ 0 to 10 V ¦ 4 to 20 mA
Gfc36 to 39	Regulation loop 1 to 4	
	Setpoint	
	Differential	
	Integral time	

9 PARAMETERS TABLE

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
A. On/Off Unit										
A01	Unit status		0	-	0	4	0: OFF ¦ 1: COMFORT ¦ 2: PRECOMFORT¦ 3: ECONOMY ¦ 4: AUTO	I	R/W	12
	Reset time????		4	Hour	0.5	16		I	R	-
	Override for		-	Hour	0.5	16		I	R	-
	Enable auto-resume		No	-	No	Yes	0:No¦ 1:Yes	I	R/W	-
B. Setpoint										
B01	Temperature	Current temperature set point	0	°C	-99.9	99.9		A	R	93
	Humidity	Current humidity set point	0	% RH	0	100		I	R	13
	External compensation	Enable: Gfc08-Gfc09 Config.: Hb03	0	°C	-99.9	99.9		A	R	-
	AIN Offset	Enable: Ha19 Configure: Hb23	0	°C	-99.9	99.9		A	R	25
B02	Comfort temp. Summer	Comfort room temp. set point (cooling)	23	°C	Min. temp. set limit in cooling (Gfc02)	Max. temp. set limit in cooling (Gfc02)		A	R/W	94
	Comfort temp. Winter	Comfort room temp. set point (heating)	23	°C	Min. temp. set limit in heating (Gfc02)	Max. temp. set limit in heating (Gfc02)		A	R/W	95
	Comfort humid. Summer	Comfort room humidity set point (cooling)	50	% RH	Min. humid. set limit in cooling (Gfc03)	Max. humid. set limit in cooling (Gfc03)		I	R/W	14
	Comfort humid. Winter	Comfort room humidity set point (heating)	50	% RH	0	100		I	R/W	15
B03	Pre-comfort temp. Summer	Precomfort room temp. set point (cooling)	25	°C	Min. temp. set limit in cooling (Gfc02)	Max. temp. set limit in cooling (Gfc02)		A	R/W	96
	Pre-comfort temp. Winter	Precomfort room temp. set point (heating)	21	°C	Min. temp. set limit in heating (Gfc02)	Max. temp. set limit in heating (Gfc02)		A	R/W	97
	Pre-comfort humid. Summer	Precomfort room humidity set point (cooling)	55	% RH	0	100		I	R/W	16
	Pre-comfort humid. Winter	Precomfort room humidity set point (heating)	45	% RH	0	100		I	R/W	17
B04	Economy temp. Summer	Economy room temp. set point (cooling)	27	°C	Min. temp. set limit in cooling (Gfc02)	Max. temp. set limit in cooling (Gfc02)		A	R/W	98
	Economy temp. Winter	Economy room temp. set point (heating)	19	°C	Min. temp. set limit in heating (Gfc02)	Max. temp. set limit in heating (Gfc02)		A	R/W	99
	Economy humid. Summer	Economy room humidity set point (cooling)	60	% RH	0	100		I	R/W	18
	Economy humid. Winter	Economy room humidity set point (heating)	40	% RH	0	100		I	R/W	19
B11	Regulation loop 1 (see Ha20…Ha23; Gfc36…Gfc39)	Setpoint	0	-	-3200	3200		A	R/W	148
		Differential	0	-	-3200	3200		A	R/W	149
		Integral time	0	s	0	999		I	R/W	129
B12	Regulation loop 2	Setpoint	0	-	-3200	3200		A	R/W	150
		Differential	0	-	-3200	3200		A	R/W	151
		Integral time	0	s	0	999		I	R/W	130
B13	Regulation loop 3	Setpoint	0	-	-3200	3200		A	R/W	152
		Differential	0	-	-3200	3200		A	R/W	153
		Integral time	0	s	0	999		I	R/W	131
B14	Regulation loop 4	Setpoint	0	-	-3200	3200		A	R/W	154
		Differential	0	-	-3200	3200		A	R/W	155
		Integral time	0	s	0	999		I	R/W	132

Mask Index	Display description			Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
C. Clock/ Scheduler												
C01	Hour			Current time	-	hh:mm	00:00	23:59		I	R/W	-
	Date			Current date	-	dd/mm/yy	01/01/00	31/12/99		I	R/W	-
	Day			Day of the week	-	Mo…Su	Mo	Su		I	R	-
C02	Enable scheduler			Enable time bands	No	-	No	Yes	0:No¦1:Yes	D	R/W	85
	Day			Day time band setting	Mo	-	Mo	Su	0: Mo…6: Su	I	R/W	25
	Copy to			Day to copy settings to	Mo	-	Mo	All	0: Mo ¦…¦ 6: Su ¦ 7: all	D	R/W	-
	No/Yes			Enable copy settings	No	-	No	Yes	0:No¦1:Yes	I	R/W	-
	F1	hh		Time band F1 start hour	8	hour	0	23		I	R/W	26
		mm		Time band F1 start minutes	30	minute	0	59		I	R/W	27
		operating mode		Time band F1 operating mode	comfort	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy	I	R/W	28
	F2	hh		Time band F2 start hour	12	hour	0	23	-	I	R/W	29
		mm		Time band F2 start minutes	30	minute	0	59	-	I	R/W	30
		operating mode		Time band F2 operating mode	pre-comfort	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comfort¦ 3: economy	I	R/W	31
	F3	hh		Time band F3 start hour	13	hour	0	23	-	I	R/W	32
		mm		Time band F3 start minutes	30	minute	0	59	-	I	R/W	33
		operating mode		Time band F3 operating mode	pre-comfort	-	0	3	0: off 1: comfort 2: pre-comf. 3: economy	I	R/W	34
	F4	hh		Time band F4 start hour	13	hour	0	23	-	I	R/W	35
		mm		Time band F4 start minutes	30	minute	0	59	-	I	R/W	36
		operating mode		Time band F4 operating mode	comfort	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy	I	R/W	37
C03	Enable holiday period			Enable holidays	No	-	No	Yes	0:No¦1:yes	D	R/W	86
	Period 1	Start	dd	Holiday period 1 start day	-	day	01	31	-	I	R/W	38
			mm	Holiday period 1 start month	-	month	01	12	-	I	R/W	39
		End	dd	Holiday period 1 end day	-	day	01	31	-	I	R/W	40
			mm	Holiday period 1 end month	-	month	01	12	-	I	R/W	41
		Set		Holiday period 1 operating mode	-	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy	I	R/W	42
	Period 2	Start	dd	Holiday period 2 start day	-	day	01	31	-	I	R/W	43
			mm	Holiday period 2 start month	-	month	01	12	-	I	R/W	44
		End	dd	Holiday period 2 end day	-	day	01	31	-	I	R/W	45
			mm	Holiday period 2 end month	-	month	01	12	-	I	R/W	46
		Set		Holiday period 2 operating mode	-	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy	I	R/W	47
	Period 3	Start	dd	Holiday period 3 start day	-	day	01	31	-	I	R/W	48
			mm	Holiday period 3 start month	-	month	01	12	-	I	R/W	49
		Fine	dd	Holiday period 3 end day	-	day	01	31	-	I	R/W	50
			mm	Holiday period 3 end month	-	month	01	12	-	I	R/W	51
		Set		Holiday period 3 operating mode	-	-	0	3	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy	I	R/W	52
C04	Enable special days				No	-	No	Yes	0:No¦1:Yes	D	R/W	87
	SD1	dd		Special day 1: day	-	day	01	31	-	I	R/W	53
		mm		Special day 1: month	-	month	01	12	-	I	R/W	54
		set		Special day 1 operating mode	-	-	-	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	55

Mask Index	Display description		Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
C04	SD 2	dd	Special day 2: day	-	day	01	31	-	I	R/W	56
		mm	Special day 2: month	-	month	01	12	-	I	R/W	57
		set	Special day 2 operating mode	-	-	0	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	58
	SD 3	dd	Special day 3: day	-	day	01	31	-	I	R/W	59
		mm	Special day 3: month	-	month	01	12	-	I	R/W	60
		set	Special day 3 operating mode	-	-	0	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	61
	SD 4	dd	Special day 4: day	-	day	01	31	-	I	R/W	62
		mm	Special day 4: month	-	month	01	12	-	I	R/W	63
		set	Special day 4 operating mode	-	-	0	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	64
	SD 5	dd	Special day 5: day	-	day	01	31	-	I	R/W	65
		mm	Special day 5: month	-	month	01	12	-	I	R/W	66
		set	Special day 5 operating mode	-	-	0	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	67
	SD 6	dd	Special day 6: day	-	day	01	31	-	I	R/W	68
		mm	Special day 6: month	-	month	01	12	-	I	R/W	69
		set	Special day 6 operating mode	-	-	0	4	0: off ¦ 1: comfort ¦ 2: pre-comf. ¦ 3: economy¦ 4: auto	I	R/W	70
C05	Enable summer time			No	-	No	Yes	0:No¦1:Yes	D	R/W	88
	Transition time			0	min	0	240		I	R/W	-
	Start	day	Daylight saving start day	last	-	4	-	0: last ¦ 1: first ¦ 2: second ¦ 3: third ¦ 4: fourth	I	R/W	-
		day of the week	Daylight saving start day of the week	Sunday	-	1	7	1: Monday ¦…¦ 7:Sunday	I	R/W	-
		month	Daylight saving start month	March	month	January	December	1: January ¦…¦ 12: December	I	R/W	-
		hour	Daylight saving start hour	02:00	hour	00:00	23:00		I	R/W	-
	End	day	Daylight saving end day	last	-	4	-	0: last ¦ 1: first ¦ 2: second ¦ 3: third ¦ 4: fourth	I	R/W	-
		day of the week	Daylight saving end day of the week	Sunday	-	1	7	1: Monday ¦…¦ 7:Sunday	I	R/W	-
		month	Daylight saving end month	March	month	January	December	1: January ¦…¦ 12: December	I	R/W	-
		hour	Daylight saving end hour	03:00	hour	00:00	23:00		I	R/W	-
D. Input/Output											
D01	Analog inputs										
	--- = Supply temperature			-	°C	-99.9	99.9		A	R	10
	--- = Return temperature			-	°C	-99.9	99.9		A	R	11
	--- = Room temperature			-	°C	-99.9	99.9		A	R	12
	--- = Supply humidity			-	%rH	0	100		I	R	13
	--- = Return humidity			-	%rH	0	100		I	R	14
	--- = Room humidity			-	%rH	0	100		I	R	15
D02	--- = Supply pressure			-	Pa	-9999	9999		I	R	1
	--- = Return pressure			-	Pa	-9999	9999		I	R	2
	--- = External temperature			-	°C	-99.9	99.9		A	R	16
	--- = External humidity			-	%rH	0	100		A	R	17

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
D03	--- = Frost temperature		-	°C	-99.9	99.9		A	R	18
	--- = Off-coil temperature		-	°C	-99.9	99.9		A	R	19
	--- = Exhaust temperature	Enable: Ha01,Ha14 (defrost probe=exhaust), Hb15	-	°C	-99.9	99.9		A	R	20
	--- = CO2		-	ppm	0	9999		I	R	3
	--- = VOC		-	%	0	100		A	R	21
D04	Water coil temperature									
	--- = Cooling- cool/heat	Enable: Hc11-Hc14; Config: Hb16	-	°C	-99.9	99.9		A	R	22
	--- = Pre - heating	Enable: Hc09; Config: Hb17	-	°C	-99.9	99.9		A	R	23
	--- = Re – heating	Enable: Hc16; Config: Hb18	-	°C	-99.9	99.9		A	R	24
D05	--- = Set offset	Enable: Ha19; Config: Hb23	-	°C	-99.9	99.9		A	R	25
	--- = Regulation loop 1	Enable: Ha19; Config: Hb19	-	-	-3200	3200		A	R	26
	--- = Regulation loop 2	Enable: Ha19; Config: Hb20	-	-	-3200	3200		A	R	27
	--- = Regulation loop 3	Enable: Ha19; Config: Hb21	-	-	-3200	3200		A	R	28
	--- = Regulation loop 4	Enable: Ha19; Config: Hb22	-	-	-3200	3200		A	R	29
D06	Enthalpy									
	Supply	Enable: Ha02	-	kJ/kg	0	999.9		A	R	-
	Return	Enable: Ha02	-	kJ/kg	0	999.9		A	R	-
	Room	Enable: Ha02	-	kJ/kg	0	999.9		A	R	-
	External	Enable: Ha02	-	kJ/kg	0	999.9		A	R	-
	Setpoint	Enable: Ha02	-	kJ/kg	0	999.9		A	R	-
D07	Digital inputs									
	--- = Remote On/Off	Enable: Ha17; Config: Hb24	0	-	0	1	0:C:closed¦1:O:open	D	R	6
	--- = Summer/Winter	Enable: Gc01; Config: Hb24	0	-	0	1	0:C:closed¦1:O:open	D	R	7
	--- = Double setpoint	Enable: Ha18; Config: Hb24	0	-	0	1	0:C:closed¦1:O:open	D	R	8
D08	--- = Generic alarm	Config: Hb25; Delay Hc20	0	-	0	1	0:C:closed¦1:O:open	D	R	9
	--- = Serious alarm	Config: Hb40	0	-	0	1	0:C:closed¦1:O:open	D	R	10
	--- = Humidifier alarm	Enable: Ha01; Config: Hb28	0	-	0	1	0:C:closed¦1:O:open	D	R	11
	--- = Frost-stat	Enable: Ha16; Config: Hb25	0	-	0	1	0:C:closed¦1:O:open	D	R	12
D09	--- = 1st supply filter	Config: Hb26	0	-	0	1	0:C:closed¦1:O:open	D	R	13
	--- = 2nd supply filter	Config: Hb26	0	-	0	1	0:C:closed¦1:O:open	D	R	14
	--- = Return filter	Enable: Ha01; Config: Hb26	0	-	0	1	0:C:closed¦1:O:open	D	R	15
	--- = Supply flow	Config: Hb27	0	-	0	1	0:C:closed¦1:O:open	D	R	16
	--- = Return flow	Enable: Ha01-Ha04; Config: Hb27	0	-	0	1	0:C:closed¦1:O:open	D	R	17
D10	Overload pump 1									
	--- = Cooling-Cool/heat	Enable: Ha09-10; Config: Hb30	0	-	0	1	0:C:closed¦1:O:open	D	R	18
	--- = Pre-heating	Enable: Ha09-11; Config: Hb30	0	-	0	1	0:C:closed¦1:O:open	D	R	19
	--- = Re-heating	Enable: Ha09-12; Config: Hb30	0	-	0	1	0:C:closed¦1:O:open	D	R	20
D11	Overload pump 2									
	--- = Cooling-Cool/heat	Enable: Ha09-10; Config: Hb31	0	-	0	1	0:C:closed¦1:O:open	D	R	21
	--- = Pre-heating	Enable: Ha09-11; Config: Hb31	0	-	0	1	0:C:closed¦1:O:open	D	R	22
	--- = Re-heating	Enable: Ha09-12; Config: Hb31	0	-	0	1	0:C:closed¦1:O:open	D	R	23
D12	Coil flow									
	--- = Cooling-Cool/heat	Enable: Ha09; Config: Hb32	0	-	0	1	0:C:closed¦1:O:open	D	R	24
	--- = Pre-heating	Enable: Ha09;Config: Hb32	0	-	0	1	0:C:closed¦1:O:open	D	R	26
	--- = Re-heating	Enable: Ha09; Config: Hb32	0	-	0	1	0:C:closed¦1:O:open	D	R	25
D13	Fans overload									
	--- = Supply 1	Enable: Ha04; Config: Hb29;	0	-	0	1	0:C:closed¦1:O:open	D	R	27
	--- = Supply 2	Enable: Ha03 (duty stand-by)-Ha04; Config: Hb29;	0	-	0	1	0:C:closed¦1:O:open	D	R	28
	--- = Return 1	Enable: Ha01-Ha04; Config: Hb29;	0	-	0	1	0:C:closed¦1:O:open	D	R	29
	--- = Return 2	Enable:Ha01-Ha03 (duty stand-by)-Ha04; Config: Hb29;	0	-	0	1	0:C:closed¦1:O:open	D	R	30
D14	--- = Supply inverter alarm	Enable: Ha03; Config: Hb28	0	-	0	1	0:C:closed¦1:O:open	D	R	31
	--- = Return inverter alarm	Enable: Ha01-Ha03; Config: Hb28	0	-	0	1	0:C:closed¦1:O:open	D	R	32
	--- = Pre-heaters overload	Enable: Ha04-Ha05; Config: Hb33	0	-	0	1	0:C:closed¦1:O:open	D	R	33
	--- = Re-heaters overload	Enable: Ha04-Ha08; Config: Hb33	0	-	0	1	0:C:closed¦1:O:open	D	R	34
D15	--- = Recovery clogged	Enable: Ha01; Config: Hb33	0	-	0	1	0:C:closed¦1:O:open	D	R	35
	--- = Filter clogged	Config: Hb34	0	-	0	1	0:C:closed¦1:O:open	D	R	36
	--- = Fire & smoke	Enable: always;Config: Hb34;	0	-	0	1	0:C:closed¦1:O:open	D	R	37
	--- = Open switch	Enable: always;Config: Hb34;	0	-	0	1	0:C:closed¦1:O:open	D	R	38
D16	Air quality demand	Enable: Ha02; Ha15; Config: Gfc30, Hc19, Hb13, Hb14	-	%	0	100		A	R	-
	Purging demand	Enable: Ha15;Config: Gg02; Hc19; Activate: Gg02	0	-	0	1	0:No¦ 1:Yes	D	R	-
	Resume time	Enable: Ha15;Config: Gg02	0	min	0	299		I	R	-

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
D17	**Digital outputs**									
	--- = Supply fan	Config: Hb35	Off	-	Off	On	0:Off¦ 1:On	D	R	39
	--- = Supply fan 2nd	Enable: Ha03 (double); Config: Hb36	Off	-	Off	On	0:Off¦ 1:On	D	R	40
	--- = Return fan	Enable: Ha01; Config: Hb35	Off	-	Off	On	0:Off¦ 1:On	D	R	41
	--- = Return fan 2nd	Enable: Ha01; Ha03 (double); Config: Hb36	Off	-	Off	On	0:Off¦ 1:On	D	R	42
D18	--- = Supply fan line	Enable: Ha03(Star-delta); Config: Hb37	Off	-	Off	On	0:Off¦ 1:On	D	R	43
	--- = Supply fan star	Enable: Ha03; Config: Hb37	Off	-	Off	On	0:Off¦ 1:On	D	R	
	--- = Supply fan delta	Enable: Ha03; Config: Hb37	Off	-	Off	On	0:Off¦ 1:On	D	R	
	--- = Return fan line	Enable: Ha01-Ha03(Star-delta); Config: Hb38	Off	-	Off	On	0:Off¦ 1:On	D	R	44
	--- = Return fan star	Enable: Ha01-Ha03; Config: Hb38	Off	-	Off	On	0:Off¦ 1:On	D	R	
	--- = Return fan delta	Enable: Ha01-Ha03; Config: Hb38	Off	-	Off	On	0:Off¦ 1:On	D	R	
D19	--- = Unit status (On/Off)	Enable: always; Config: Hb41	Off	-	Off	On	0:Off¦ 1:On	D	R	45
	--- = Humidifier	Enable: Ha01-Ha13; Config: Hb35	Off	-	Off	On	0:Off¦ 1:On	D	R	46
	--- = Rotary recovery/ Run around coil	Enable: Ha14; Config: Hb39	Off	-	Off	On	0:Off¦ 1:On	D	R	47
	--- = Recovery heater	Enable: Ha14; Config: Hb41	Off	-	Off	On	0:Off¦ 1:On	D	R	48
D20	--- = Global alarm	Config: Hb40	Off	-	Off	On	0:Off¦ 1:On	D	R	49
	--- = Serious alarm	Enable: always; Config: Hb40	Off	-	Off	On	0:Off¦ 1:On	D	R	50
	--- = Minor alarm	Enable: always; Config: Hb40	Off	-	Off	On	0:Off¦ 1:On	D	R	51
	--- = Filter alarm	Enable: always; Config: Hb41	Off	-	Off	On	0:Off¦ 1:On	D	R	52
D21	--- = Fresh air damper	Enable: Ha02; Config: Hb39	Off	-	Off	On	0:Off¦ 1:On	D	R	53
	--- = By-pass damper	Enable: Ha14; Config: Hb39	Off	-	Off	On	0:Off¦ 1:On	D	R	54
	--- = Re-heater 1	Enable: Ha08; Config: Hb49	Off	-	Off	On	0:Off¦ 1:On	D	R	55
	--- = Re-heater 2	Enable: Ha08; Config: Hb49	Off	-	Off	On	0:Off¦ 1:On	D	R	56
	--- = Re-heater 3	Enable: Ha08; Config: Hb49	Off	-	Off	On	0:Off¦ 1:On	D	R	57
	--- = Re-heater 4	Enable: Ha08; Config: Hb49	Off	-	Off	On	0:Off¦ 1:On	D	R	58
D22	--- = Pre-heater 1	Enable: Ha05; Config: Hb48	Off	-	Off	On	0:Off¦ 1:On	D	R	59
	--- = Pre-heater 2	Enable: Ha05; Config: Hb48	Off	-	Off	On	0:Off¦ 1:On	D	R	60
	--- = Pre-heater 3	Enable: Ha05; Config; Hb48	Off	-	Off	On	0:Off¦ 1:On	D	R	61
	--- = Pre-heater 4	Enable: Ha05; Config:Hb48	Off	-	Off	On	0:Off¦ 1:On	D	R	62
D23	--- = Cooling step 1	Enable: Ha06 (Dir. Expans.); Config: Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	63
	--- = Cooling step 2	Enable: Ha06 (Dir. Expans.); Config: Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	64
	--- = Cooling step 3	Enable: Ha06 (Dir. Expans.); Config: Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	65
	--- = Cool/ heat step 1	Enable: Ha01-Ha07(steps);Config:Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	63
	--- = Cool/ heat step 2	Enable: Ha01-Ha07(steps);Config:Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	64
	--- = Cool/ heat step 3	Enable: Ha01-Ha07(steps);Config:Hb47	Off	-	Off	On	0:Off¦ 1:On	D	R	65
	--- = Cool/ Heat	Enable: Ha01; Config: Hb42	Off	-	Off	On	0:Cool¦ 1:Heat	D	R	66
D24	Pump 1									
	--- = Cooling- Cool/heat	Enable: Ha01-Ha09; Config: Hb43	Off	-	Off	On	0:Off¦ 1:On	D	R	67
	--- = Pre-heating	Enable: Ha01-Ha09; Config: Hb43	Off	-	Off	On	0:Off¦ 1:On	D	R	68
	--- = Re-heating	Enable: Ha01-Ha09;Config: Hb43	Off	-	Off	On	0:Off¦ 1:On	D	R	69
D25	Pump 2									
	--- = Cooling- Cool/heat	Enable: Ha01-Ha09; Config: Hb44	Off	-	Off	On	0:Off¦ 1:On	D	R	70
	--- = Pre-heating	Enable: Ha01-Ha09; Config: Hb44	Off	-	Off	On	0:Off¦ 1:On	D	R	71
	--- = Re-heating	Enable: Ha01-Ha09;Config: Hb44	Off	-	Off	On	0:Off¦ 1:On	D	R	72
D26	--- = Cooling floating valve open	Enable: Ha01-Ha06; Config: Hb45	Off	-	Off	On	0:Off¦ 1:On	D	R	73
	--- = Cooling floating valve close	Enable: Ha01-Ha07; Config: Hb46	Off	-	Off	On	0:Off¦ 1:On	D	R	73
	--- = Cool/heat floating valve open	Enable: Ha01-Ha06; Config: Hb45	Off	-	Off	On	0:Off¦ 1:On	D	R	74
	--- = Cool/heat floating valve close	Enable: Ha01-Ha07; Config: Hb46	Off	-	Off	On	0:Off¦ 1:On	D	R	74
	--- = Preheating floating valve open	Enable: Ha01-Ha05; Config: Hb45	Off	-	Off	On	0:Off¦ 1:On	D	R	75
	--- = Preheating floating valve close	Enable: Ha01-Ha05; Config: Hb46	Off	-	Off	On	0:Off¦ 1:On	D	R	76
	--- = Reheating floating valve open	Enable: Ha01-Ha08; Config: Hb45	Off	-	Off	On	0:Off¦ 1:On	D	R	77
	--- = Reheating floating valve close	Enable: Ha01-Ha08; Config: Hb46	Off	-	Off	On	0:Off¦ 1:On	D	R	78
D27	--- = Regulation loop 1	Enable: Ha19; Config: Hb50	Off	-	Off	On	0:Off¦ 1:On	D	R	79
	--- = Regulation loop 2	Enable: Ha19; Config: Hb50	Off	-	Off	On	0:Off¦ 1:On	D	R	80
	--- = Regulation loop 3	Enable: Ha19; Config: Hb50	Off	-	Off	On	0:Off¦ 1:On	D	R	81
	--- = Regulation loop 4	Enable: Ha19; Config: Hb50	Off	-	Off	On	0:Off¦ 1:On	D	R	82

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
D28	**Analog outputs**									
	--- = Supply fan	Enable: Ha03 (inverter); Config: Hb51	0	%	0	100		A	R	35
	--- = Return fan	Enable: Ha01-Ha03 (inverter); Config:Hb52	0	%	0	100		A	R	36
	--- = Exhaust damper	Enable: Ha02; Config: Hb55	0	%	0	100		A	R	37
	--- = Fresh air damper	Enable: Ha02; Config: Hb53	0	%	0	100		A	R	38
	--- = Mixing damper	Enable: Ha02; Config: Hb54	0	%	0	100		A	R	40
D29	--- = Bypass damper	Enable; Ha14; Config: Hb56	0	%	0	100		A	R	39
	--- = Rotary recovery	Enable: Ha14; Config: Hb63	0	%	0	100		A	R	44
	--- = Preheat heaters	Enable: Ha01-Ha05; Config: Hb60	0	%	0	100		A	R	43
	--- = Reheat heaters	Enable: Ha01-Ha08; Config: Hb62	0	%	0	100		A	R	42
D30	--- = Humidifier	Enable: Ha13; Config: Hb57	0	%	0	100		A	R	41
	Valve									
	--- = Cooling – Cool/heat %	Enable: Ha01-Ha06; Config: Hb59	0	%	0	100		A	R	45
	--- = Preheating%	Enable: Ha05; Config: Hb58	0	%	0	100		A	R	47
	--- = Reheating %	Enable: Ha08; Config: Hb61	0	%	0	100		A	R	46
D31	--- = Regulation loop 1	Enable: Ha19; Config: Hb64	0	%	0	100		A	R	48
	--- = Regulation loop 2	Enable: Ha19; Config: Hb65	0	%	0	100		A	R	49
	--- = Regulation loop 3	Enable: Ha19; Config: Hb66	0	%	0	100		A	R	50
	--- = Regulation loop 4	Enable: Ha19; Config: Hb67	0	%	0	100		A	R	51
D40	**Supply VFD**									
	Status		0	-	0	1	0: not ready¦ 1: ready	D	R	-
	Run		0	-	0	1	0: stop ¦ 1: run	D	R	-
	Direction		0	-	0	1	0: → ¦1: ←	D	R	-
	Alarms		0	-	0	1	0: No alarms¦ 1: active	D	R	-
	Speed status		0	-	0	1	0: ramping¦ 1: reference reached	D	R	-
D41	Request		0	-	0	100		A	W	53
	Feedback		0	-	-99.9	99.9		A	W	-
	Dissipator temperature		0	°C	-999	999		I	R	4
	DC voltage		0	V	0	9999		I	R	5
D42	**Motor data**									
	Speed		0	-	-9999	9999		I	W	-
	Voltage		0	V	-9999	9999		A	R	54
	Current		0	A	-99.9	99.9		A	R	55
	Torque		0	%	-9999	9999		A	R	56
	Power		0	%	-999.9	999.9		A	R	57
D50	**Return VFD**									
	Status		0	-	0	1	0: not ready¦ 1: ready	D	R	-
	Run		0	-	0	1	0: stop ¦ 1: run	D	R	-
	Direction		0	-	0	1	0: → ¦1: ←	D	R	-
	Alarms		0	-	0	1	0: No alarms¦ 1: active	D	R	-
	Speed status		0	-	0	1	0: ramping¦ 1: reference reached	D	R	-
D51	Request		0	-	0	100		A	W	59
	Feedback		0	-	-99	99		A	W	-
	Dissipator temperature		0	°C	-999	999		I	R	7
	DC voltage		0	V	0	9999		I	R	8
D52	**Motor data**									
	Speed		0	-	-9999	9999		I	R	-
	Voltage		0	V	-9999	9999		A	R	60
	Current		0	A	-99.9	99.9		A	R	61
	Torque		0	%	-999.9	999.9		A	R	62
	Power		0	%	-999.9	999.9		A	R	63

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
D60	**Belimo 1…8**	Enable: Ha24-Ha27-Ha28-Ha60…83; Config: -								
D62 D64 D66 D68	Request		0	-	0	9	0: Close¦ 1: Override open¦ 2: Open	A	R/W	65;67; 69;71; 73;75; 77;79
D70 D72 D74	Actual position		0	%	0	100		A	R	66;68; 70;72; 74;76; 78;80
	Actual flow		0	m3/h	0	100		A	R	-
	External input			%	0	100		I	R	-
			0	-	0	1	0: Open¦ 1: Close	D	R	-
	Net alarm		0	-	0	-	0: no alarm¦ 1: offline¦ 2: unknown command¦ 3: unpermitted command¦ 4: device error	I	R	-
D61 D63	Belimo 1…8 information									
D65	SW version		0	-	-	-		I	R	-
D67 D69 D71 D73 D75	Serial number		0	-	-	-	-	I	R	-
D81	Serial probe n°1…6	Enable: Ha26; Config: Ha31-Ha91	0	-	0	99		I	W	-
D82	Temperature		0	°C	-	-		A	W	-
D83	Humidity		0	% RH	-	-		A	W	-
D84 D85 D86	Dew point		0	°C	-	-		A	W	-
E. Data logger										
E01	Alarm Nr.-hour-date Code – Description Supply temperature – Return temperature	Pressing the bell button displays the alarm log. For the complete list see chap. Alarms	0	-	0	99		I	R/W	-
F. Board switch: see chapter "Description of the Menus"										
G. Service										
a.	**Change language**									
Ga01	ENTER to change ESC to confirm		0	-	0	9	0:Italian¦1: English¦2:Spanish	I	R/W	-
Ga02	Disable language mask at startup		No	-	No	Yes	0:No¦ 1:Yes	D	R/W	-
	Display countdown		60	s	0	999		I	R	-
b.	**Information**									
Gb01	Software code – Version - date Manual: Bios: …; Date …; Boot: …; Date …;		0	-	0	99		I	R	-
Gb02	pCO type		0	-	1	10	0: pCO2¦ 1: pCO1 ¦ 2: pCO2¦ 3: pCOC¦ ¦ 4: pCOXS¦ ¦ 5: pCOOEM¦ ¦ 6: -¦ 7: PCO3¦ ¦ 8: Snode¦9: -¦ ¦ 10: pCO5¦	I	R/W	-
	Type of pCO controller		0	-	0	99	10: Large¦ 11: Medium ¦ 12: Small ¦ 13: XL N.O. ¦ 17: XL N.C.	I	R/W	-
	Total flash		0	-	0	9999		I	R/W	-
	Ram		0	-	0	9999		I	R/W	-
	Built-in type		0	-	0	9	0: No¦ 2: pGD0¦ 3: pGD1	I	R	-
	Main cycle		0	-	0	9999		A	W	-
	Cycle/s		0	-	0	9999		I	R	-

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
c.	**Summer/winter**									
Gc01	Season selection from		0	-	0	5	0:Keyboard¦1: Digital input¦ 2:B.M.S.¦ 3:Keyboard/B.M.S.¦4:Auto¦5: H_2O temperature	I	R/W	133
Gc02	Set season		0	-	0	1	0:Auto¦1:Fix days	D	R/W	174
	Summer start		15/05	dd/mm	01/01	31/12		I	R/W	134-5
	Winter start		30/09	dd/mm	01/01	31/12		I	R/W	136-7
	Threshold summer		25	°C	-99.9	99.9		A	R/W	156
	Threshold winter		10	°C	-99.9	99.9		A	R/W	157
	Delay change		1	hour	0	999		I	R/W	138
Gc03	Season threshold	Enable: Gc01=temp.H2O, Hc14, Hb16								
	Summer		25	°C	-99.9	99.9		A	R/W	
	Winter		30	°C	-99.9	99.9		A	R/W	
d.	**Working hours**									
Working hours										
Gd01	Supply fan		0	hour	0	999		I	R	146-7 *
	Return fan		0	hour	0	999		I	R	150-1 *
	Humidifier		0	hour	0	999		I	R	154-5 *
	Rotary recovery		0	hour	0	999		I	R	156-7 *
Gd02	Cool pump 1		0	hour	0	999		I	R	158-9 *
	Cool pump 2		0	hour	0	999		I	R	160-1 *
	Preheat pump 1		0	hour	0	999		I	R	162-3 *
	Preheat pump 2		0	hour	0	999		I	R	164-5 *
	Reheat pump 1		0	hour	0	999		I	R	166-7 *
	Reheat pump 2		0	hour	0	999		I	R	168-9 *
Gd03	Preheating heaters									
	Heater 1		0	hour	0	999		I	R	170*-1
	Heater 2		0	hour	0	999		I	R	172*-3
	Heater 3		0	hour	0	999		I	R	174*-5
	Heater 4		0	hour	0	999		I	R	176*-7
Gd04	Reheating heaters									
	Heater 1		0	hour	0	999		I	R	178*-9
	Heater 2		0	hour	0	999		I	R	180*-1
	Heater 3		0	hour	0	999		I	R	182*-3
	Heater 4		0	hour	0	999		I	R	184*-5
e.	**BMS Configuration**									* =Working hours X 1000
Ge01	BMS protocol		0	-	0	2	0:CAREL¦1:MODBUS¦ 2:LON¦	I	R/W	-
	Baud rate		0	bps	0	4	0:1200 ¦1:2400 ¦ 2:4800 ¦3:9600 ¦ 4:19200	I	R/W	-
	Address		1	-	0	207		I	R/W	-
Ge02	BMS offline alarm enable		0	-	0	1	0:No¦1:Yes	I	R/W	-
	Timeout		0	s	0	900	-	I	R	-
Ge03	Press ENTER to ENABLE commissioning service /Connect the BMS port		0	-	0	1	0:No¦1:Yes	D	R	-
f.	**Service settings**									
a.	**Working hour set**									
Gfa01	Supply fan									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd01)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Return fan									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd01)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
Gfa02	Humidifier									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd01)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Rotary recovery									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd01)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Gfa03/4	Pumps 1/2	-								
	Cooling									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd02)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Preheating									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd02)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Reheating									
	Threshold		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd02)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
Gfa05	Preheating heaters									
	Threshold heater 1		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd03)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Threshold heater 2		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd03)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Threshold heater 3		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd03)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Reset (acts on counter Gd03)		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd03)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
Gfa06	Reheating heaters									
	Threshold heater 1		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd04)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Threshold heater 2		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd04)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Threshold heater 3		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd04)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
	Threshold heater 4		0	hour	0	99000		I	R/W	-
	Reset (acts on counter Gd04)		0	-	0	1	0:N=No ¦ 1:Y=Yes	D	R/W	-
b.	**Probe adjustment**									
Gfb01	Supply temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		-	°C	-99.9	99.9		A	R	10
	Return temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		-	°C	-99.9	99.9		A	R	11
	Return temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		-	°C	-99.9	99.9		A	R	16
Gfb02	Supply humidity									
	Offset		0	% RH	-20	20		I	R/W	-
	Probe		0	% RH	0	100		A	R	13
	Return humidity									
	Offset		0	% RH	-20	20		I	R/W	-
	Probe		0	% RH	0	100		A	R	14
	External humidity									
	Offset		0	% RH	-20	20		I	R/W	-
	Probe		0	% RH	0	100		I	R	17
Gfb03	Supply pressure									
	Offset		0	Pa	-200	200		I	R/W	-
	Probe		0	Pa	-9999	9999		I	R	1
	Return pressure									
	Offset		0	Pa	-200	200		I	R/W	-
	Probe		0	Pa	-9999	9999		I	R	2
Gfb04	CO2 air quality									
	Offset		0	ppm	-99	99		I	R/W	-
	Probe		0	ppm	0	9999		I	R	3
	VOC air quality									
	Offset		0	%	-50	50		I	R/W	-
	Probe		0	%	0	999		A	R	-
Gfb05	Frost temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	18
	Off-coil temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	19
	Exhaust temperature									
	Offset		0	°C	-9.9	9.9		I	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	20

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Gfb06	Cool water temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	22
	Preheat water temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	23
	Reheat water temperature									
	Offset		0	°C	-9.9	9.9		A	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	24
Gfb07	Room temperature									
	Offset		0	°C	-9.9	9.9		I	R/W	-
	Probe		0	°C	-99.9	99.9		A	R	12
	Room humidity									
	Offset		0	% RH	-99.9	99.9		A	R/W	-
	Probe		0	% RH	0	100		A	R	-
Gfb08	Regulation loop probes 1/2/3/4									
	Offset		0		-20	20		A	R/W	-
	Probe		0		-3200	3200		I	R	26;27;28;29
c.	**Thermoregulation**									
Gfc01	Main mask information									
	1st row		Return temperature	-	0	14	0:None 1:Supply temp.¦ 2:Return temp.¦ 3:Room temp.¦ 4:External temp¦ 5:Temp setpoint¦ 6: Supply humid.¦ 7: Return humid.¦8:Room humid.¦ 9:Ext. humid.¦ 10: Humid. setpoint¦ 11:Supply pressure.¦ 12:Return pressure¦ 13: CO2 quality¦ 14: VOC quality	I	R/W	
	2nd row		Return humidity	-	0	14	See 1st row	I	R/W	
Gfc02	Temperature set limits									
	Summer low		15	°C	-99.9	99.9		A	R/W	106
	Summer high		35	°C	Summer low	99.9		A	R/W	107
	Winter low		15	°C	-99.9	99.9		A	R/W	108
	Winter high		35	°C	Winter low	99.9		A	R/W	109
Gfc03	Humidity set limits									
	Summer low		30	% RH	0	100		I	R/W	71
	Summer high		90	% RH	Summer low	100		I	R/W	72
	Winter low		30	% RH	0	100		I	R/W	73
	Winter high		90	% RH	Winter low	100		I	R/W	74
Gfc04	Temperature regulation									
	Regulation type		Prop+integr				0:Proportional¦ 1:Prop.+Integr.¦ 2:PID	I	R/W	75
	Auto cool/heat		No	-	No	Yes	0:No¦1:Yes	D	R/W	168
	Supply limits		None	-	1	4	1:None¦2:High¦3:Low¦4:High/Low	I	R/W	76
Gfc05	Cooling regulation									
	Differential		2	°C	0	99.9		A	R/W	110
	Neutral zone		1	°C	0	99		A	R/W	111
	Integral time		300	s	0	999		I	R/W	77
	Derivative time		0	s	0	999		I	R/W	78

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Gfc06	Heating regulation									
	Differential		2	°C	0	99.9		A	R/W	112
	Neutral zone		1	°C	0	99		A	R/W	113
	Integral time		300	s	0	999		I	R/W	79
	Derivative time		0	s	0	999		I	R/W	80
Gfc07	Temperature supply limits									
	Summer high		40	°C	-99.9	99.9		A	R/W	116
	Winter high		40	°C	-99.9	99.9		A	R/W	117
	Summer low		10	°C	-99.9	99.9		A	R/W	114
	Winter low		10	°C	-99.9	99.9		A	R/W	115
	Differential		3	°C	0	99.9		A	R/W	118
	Integral time		150	s	0	999		I	R/W	81
	Enable double action	Enable: Gfc04: Auto cool/heat: yes Supply limits: alto/basso	No	-	No	Yes	0:No¦1:Yes	D	R/W	169
Gfc08	Type of summer setpoint compensation		None	-	-	-	0:None ¦ 1:External ¦ 2:Room ¦ 3:Return	I	R/W	82
	Compensation delta		2	°C	-99.9	99.9		A	R/W	121
	Compensation start		25	°C	-99.9	99.9		A	R/W	119
	Compensation end		32	°C	-99.9	99.9		A	R/W	120
Gfc09	Type of winter setpoint compensation		None	-	-	-	0:None ¦ 1:External ¦ 2:Room ¦ 3:Return	I	R/W	83
	Compensation delta		-2	°C	-99.9	99.9		A	R/W	124
	Compensation start		0	°C	-99.9	99.9		A	R/W	122
	Compensation end		-8	°C	-99.9	99.9		A	R/W	123
Gfc10	Humidity regulation									
	Regulation type		Proport				0:Proportional ¦ 1:Proportional+ Integral ¦2:PID	I	R/W	84
	Auto hum/dehum		No	-	No	Yes	0:No ¦ 1:Yes	D	R/W	170
	Supply limits						1: none ¦ 2: high ¦ 3: low ¦ 4: high/low	I	R/W	85
Gfc11	Dehumidification regulation									
	Differential		5	% RH	0	100		I	R/W	86
	Neutral zone		2	% RH	0	100		I	R/W	87
	Integral time		300	s	0	999		I	R/W	88
	Derivative time		0	s	0	99		I	R/W	89
Gfc12	Humidification regulation									
	Differential		4	% RH	0	100		I	R/W	90
	Neutral zone		2	% RH	0	100		I	R/W	91
	Integral time		300	s	0	999		I	R/W	92
	Derivative time		0	s	0	99		I	R/W	93
Gfc13	Humidity supply limits	Enable: Hc01 (Humidity probe ≠ supply)								
	High limit		100	% RH	0	100		I	R/W	95
	Low limit		0	% RH	0	100		I	R/W	94
	Differential		4	% RH	0	100		I	R/W	96
	Integral time		150	s	0	999		I	R/W	97
Gfc14	Priority	-	0	-	0	1	0: Temperature¦ 1: Humidity	D	R/W	171
Gfc15	Freecooling/Freeheating dampers settings									
	Temperature differential		4	°C	0	99.9		A	R/W	125
	Enthalpy differential		5	kJ/kg	0	99.9		A	R/W	126
Gfc16	Enthalpy management									
	Atmospheric pressure		1090	mbar	600	1100		I	R/W	98

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Gfc17	Supply inverter									
	Min/ fixed power		30	%	0	Max power		A	R/W	127
	Max power		100	%	Min power	100		A	R/W	128
	Return inverter									
	Min/ fixed power		30	%	0	Max power		A	R/W	129
	Max power		100	%	Min power	100		A	R/W	130
Gfc18	Supply flow control									
	Setpoint		1500	Pa	0	2000		I	R/W	99
	Differential		300	Pa	0	1000		I	R/W	100
	Integral time		300	s	0	9999		I	R/W	101
	Derivative time		10	s	0	9999		I	R/W	102
Gfc19	Return flow control									
	Setpoint		1500	Pa	0	2000		I	R/W	103
	Differential		300	Pa	0	1000		I	R/W	104
	Integral time		300	s	0	9999		I	R/W	105
	Derivative time		10	s	0	9999		I	R/W	106
Gfc20	Cooling cascade									
	Freecooling		50	%	0	100		I	R/W	107
	Coil		50	%	0	100		I	R/W	108
	Recovery		40	%	0	100		I	R/W	109
	Coil		40	%	0	100		I	R/W	110
Gfc21	Heating cascade									
	Freeheating		50	%	0	100		I	R/W	111
	Coil		50	%	0	100		I	R/W	112
	Recovery		40	%	0	100		I	R/W	114
	Coil		40	%	0	100		I	R/W	115
Gfc22	Heating cascade	Enable: Ha08: Reheating operation = supplement								
	Reheating		80	%	0	100		I	R/W	116
Gfc23	Minimum cooling valve opening									
	Cooling		0	%	0	100		I	R/W	117
	Dehumidification		0	%	0	100		I	R/W	118
	Unit off		0	%	0	100		I	R	-
	Only antiblock		No	-	No	Yes	0:No¦1:Yes	D	R	-
Gfc24	Minimum preheating valve opening		0	%	0	100		I	R/W	119
	Unit off		0	%	0	100		I	R	-
	Only antiblock		No	-	No	Yes	0:No¦1:Yes	D	R	-
Gfc25	Preheating coil settings when humidifying									
	Setpoint		23	°C	-99.9	99.9		A	R/W	131
	Differential		2	°C	0	99.9		A	R/W	132
Gfc26	Minimum heat/cool valve opening									
	Cooling		0	%	0	100		I	R/W	121
	Dehumidification		0	%	0	100		I	R/W	122
	Heating		0	%	0	100		I	R/W	123
	Unit off		0	%	0	100		I	R	-
	Only antiblock		No	-	No	Yes	0:No¦1:Yes	D	R	-
Gfc27	Preheating coil settings when humidifying									
	Setpoint		20	°C	-99.9	99.9		A	R/W	133
	Differential		2	°C	0	99.9		A	R/W	134
Gfc28	Reheating coil compensation setting									
	Setpoint		24	°C	-99.9	99.9		A	R/W	135
	Differential		3	°C	0	99.9		A	R/W	136
Gfc29	Minimum reheat valve opening		0	%	0	100		I	R/W	120
	Unit off		0	%	0	100		I	R	-
	Only antiblock		No	-	No	Yes	0:No¦1:Yes	D	R	-
Gfc30	Air quality with CO2									
	Setpoint		1200	ppm	0	5000		I	R/W	124
	Differential		200	ppm	0	5000		I	R/W	126
	Air quality with VOC									
	Setpoint		50	%	0	100		I	R/W	125
	Differential		10	%	0	100		I	R/W	127

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Gfc31	Heat recovery temperature activation									
	Delta recovery		5	°C	0	99.9		A	R/W	137
	Differential recovery		3	°C	0	99.9		A	R/W	138
	Enthalpy regulation									
	Differential		5	kJ/kg	0	99.9		A	R/W	139
Gfc32	Heat recovery defrost									
	Setpoint		-1	°C	-99.9	10		A	R/W	140
	Differential		4	°C	0	99.9		A	R/W	141
	Heater offset		3	°C	0	99.9		A	R/W	142
	Wheel min speed		100	%	0	100		I	R/W	128
Gfc33	Frost settings									
	Setpoint		5	°C	-99.9	99.9		A	R/W	143
	Differential		3	°C	0	99.9		A	R/W	144
Gfc34	Room frost protection enable		0	-	0	1	0: No¦1: Yes	D	R/W	172
	Threshold		5	°C	-99.9	99.9		A	R/W	145
Gfc35	Adiabatic humidifier - Supply low temperature limit									
	Enable limit		No	-	No	Yes	0: No¦1: Yes	D	R/W	173
	Setpoint		15	°C	0	99.9		A	R/W	146
	Differential		2	°C	0	99.9		A	R/W	147
Gfc36	Regulation loop 1									
	Setpoint		0	-	-3200	3200		A	R/W	148
	Differential		0	-	-3200	3200		A	R/W	149
	Integral time		0	s	0	999		I	R/W	129
Gfc37	Regulation loop 2									
	Setpoint		0	-	-3200	3200		A	R/W	150
	Differential		0	-	-3200	3200		A	R/W	151
	Integral time		0	s	0	999		I	R/W	130
Gfc38	Regulation loop 3									
	Setpoint		0	-	-3200	3200		A	R/W	152
	Differential		0	-	-3200	3200		A	R/W	153
	Integral time		0	s	0	999		I	R/W	131
Gfc39	Regulation loop 4									
	Setpoint		0	-	-3200	3200		A	R/W	154
	Differential		0	-	-3200	3200		A	R/W	155
	Integral time		0	s	0	999		I	R/W	132
d.	**User device /Change PW1**									
Gfd01	Load configuration		No	-	No	Yes	0: No¦ 1: Yes	D	R/W	-
	Last saving		--/--/--	dd/mm/yy	00/00/00	99/99/99		D	R/W	-
Gfd02	Delete data logger		No	-	No	Yes	0: No¦ 1: Yes	D	R/W	-
Gfd03	Insert new service password (PW1)		1234	----	0000	9999	-	I	R	
g.	**Manual management**									
Gg01	Supply fan		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	139
	Return fan		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	140
	Cooling -Cool/heat coil		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	141
	Preheating coil		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	142
	Reheating coil		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	143
	Humidifier		Auto	%	0	101	0:Auto¦ 1:0%; ¦101=100%	I	R/W	145
Gg02	Air quality									
	Start purging		No	-	No	Yes	0: No ¦ 1: Yes	D	R/W	175
	Stop purging		No	-	No	Yes	0: No ¦ 1: Yes	D	R/W	176
	>> Cleaning active <<		0	-	0	1	0: No ¦ 1: Yes	D	R	-
	Purging time									
	Resume time		0	min	0	999		I	W	-
	Repeat at start-up		No	-	No	Yes	0: No ¦ 1: Yes	D	R	-
Gg40	Supply VFD									
	Reset alarms		No	-	No	Yes	0: No ¦ 1: Yes	D	R/W	177
Gg50	Return VFD									
	Reset alarms		No	-	No	Yes	0: No ¦ 1: Yes	D	R/W	178
Gg60	Belimo1…Belimo8									
Gc61	Start adaptation		No	-	No	Yes		D	R/W	
Gc62	Start testrun		No	-	No	Yes		D	R/W	
Gc63	Adapted angle		Yes	-	No	Yes		D	R/W	
Gc64 Gc65 Gc66 Gc67	Alarms reset		No		No	Yes		D	R/W	

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
H. Manufacturer										
a.	**Configuration**									
Ha01	Main device enable									
	Fans		Supply-Return	-	Supply	Supply-return	0: Supply¦ 1: Supply-Return	D	R/W	-
	Coil		Cool+Preheat+Reheat				0: None ¦ 1:Cool+Preheat+Reheat¦ 2: Cooling ¦ 3: Heating ¦ 4: Cooling+Preheating ¦ 5: Cooling+Reheating ¦ 6: Cool/Heat coil ¦ 7: Cool/Heat coil +Reheat	I	R/W	-
	Humidifier		Enabled	-	Disabled	Enabled	0: Disabled ¦1: Enabled	D	R/W	-
	Recovery		Enabled	-	Disabled	Enabled	0: Disabled ¦1: Enabled	D	R/W	-
Ha02	Dampers type		Fresh air+ mixing				1: Fresh air (On/Off) ¦ 2: fresh air (Mod) ¦ 3: Fresh air+Mixing ¦ 4:Fresh air +Mix+Exhaust ¦5: Fresh air(Mod) +Exhaust	I	R/W	-
	Freecooling		Temperature	-	1	3	1: None ¦ 2: Temperature ¦ 3: Enthalpy	I	R/W	-
	Freeheating		Temperature	-	1	3	1: None ¦ 2: Temperature ¦ 3: Enthalpy	I	R/W	-
	Enable air quality management		Yes	-	0	1	0: No ¦ 1: Yes	D	R/W	-
Ha03	Fan type		Inverter	-	1	6	1: On-Off(Direct start) ¦ 2: On-Off(Star-delta) ¦3: On-Off(Double.) 4: Inverter ¦ 5: On-Off(2 speed) ¦ 6: On-Off(Duty stand-by)	I	R/W	-
	Fan Regulation		Static pressure	-	1	6	1: Static pressure ¦ 2: Air quality ¦ 3: Fixed speed	I	R/W	-
Ha04	Fan alarms									
	Overload		Supply+return	-	1	3	1: None ¦ 2: Supply ¦ 3: Supply+return	I	R/W	-
	Air flow		Supply+return	-	0	3	1: None ¦ 2: Supply ¦ 3: Supply+return	I	R/W	-
	Air flow from		Pressure switch	-	0	1	0: Pressure switch ¦ 1: Transducer	D	R/W	-
	Stop action		Individual	-	0	1	0: Individual ¦1: All	D	R/W	-
Ha05	Preheating output		Modulating valve		1	3	1: Modulating valve¦ 2: Floating valve ¦ 3: Heaters	I	R/W	-
	Heaters number		0	-	1	4		I	R/W	-
	Heaters type		On/Off	-			1: On/Off ¦ 2: Modulating ¦ 3: On/Off binary (2 heaters)	I	R/W	-
	Temperature probe when humidifying		Off coil	-			0: Off coil ¦ 1: Regulation	D	R/W	-
Ha06	Cooling output type		Modulating valve	-	1	3	1: Modulating valve ¦ 2: Floating valve ¦ 3: Direct expansion	I	R/W	-
	Cooling steps (direct expansion)		1	-	1	3		I	R/W	-
	Dehumidification		On regulation probe	-	1	3	1: On regulation probe 2: On dew point 3: Disabled	I	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Ha07	Heat cool output	Enable: Ha01	Modulating valve	-	1	3	1: Modulating valve ¦ 2: Floating valve ¦ 3: Steps	I	R/W	-
	Dehumidification		On regulation probe	-	1	3	1: On regulation probe ¦ 2: On dew point ¦ 3: Disabled	I	R/W	-
	Temperature probe when humidifying		Off-coil	-	0	1	0: Off-coil 1: Regulation	D	R/W	-
Ha08	Reheating output		Heaters	-	1	3	1: Modulating valve ¦ 2: Floating valve ¦ 3: Heaters	I	R/W	-
	Heaters number		3	-	1	4		I	R/W	-
	Heaters type		On/Off	-	1	3	1: On/Off ¦ 2: Modulating ¦ 3: On/Off binary (2 heaters)	I	R/W	-
	Reheating working mode		Compensation	-	1	3	1: Integration ¦ 2: Compensation ¦ 3: Compensation+Integrat.	I	R/W	-
Ha09	Enable water pumps Cooling-Cool/heat	Cool/heat (Ha01)	No	-	0	1	0:No¦1:Yes	D	R/W	-
	Preheating		No	-	0	1	0:No¦1:Yes	D	R/W	-
	Reheating		No		0	1	0:No¦1:Yes	D	R/W	-
	Enable flow feedback		No		0	1	0:No¦1:Yes	D	R/W	-
Ha10	Cooling – cool/ heat pumps									
	Number of pumps		2	-	1	2		I	R/W	-
	Warning limit		3	-	0	5		I	R/W	-
	Enable antiblock		Yes	-	0	1	0:No¦1:Yes	D	R/W	-
Ha11	Preheating pumps									
	Number of pumps		2	-	1	2		I	R/W	-
	Warning limit		3	-	0	5		I	R/W	-
	Enable antiblock		Yes	-	0	1	0:No¦1:Yes	D	R/W	-
Ha12	Reheating pumps									
	Number of pumps		2	-	1	2		I	R/W	-
	Warning limit		3	-	0	5		I	R/W	-
	Enable antiblock		Yes	-	0	1	0:No¦1:Yes	D	R/W	-
Ha13	Humidifier									
	Type		Adiabatic (modulating control)	-	1	4	1: Isothermic (On/Off control)¦2: Isothermic (Modulating control) ¦ 3:Adiabatic (On/Off control)¦ 4: Adiabatic (Modulating control)	I	R/W	-
Ha14	Heat recovery type		Plate exchanger	-	1	5	1: None ¦ 2: Plate exchanger¦ 3: Run around coil ¦ 4: Modulating rotary exchanger¦ 5: On/Off rotary exchanger	I	R/W	-
	Regulation		Temperature	-	0	1	0: Temperature ¦ 1: Enthalpy (rotary exchanger)	D	R/W	-
	Bypass damper		On/Off	-	1	3	1: None ¦ 2: On/Off ¦ 3: Modulating	I	R/W	-
	Wheel min speed (Modulating rotary exchanger)		0%	%	0	100	0…100%	I	R/W	-
	Defrost probe		External-Return	-	0	3	0: None ¦ 1: External-return ¦ 2: Exhaust ¦ 3: External	I	R/W	-
	Recovery heater		No		0	1	0:No¦1:Yes	D	R/W	-
Ha15	Air quality									
	Regulation type		P+I	-	1	2	1: Proportional ¦ 2: P+I	I	R/W	-
	Probe type		CO2	-	1	3	1: CO2 ¦ 2: CO2+VOC ¦ 3: VOC	I	R/W	-
	Enable purging		Yes		0	1	0:No¦1:Yes	D	R/W	-
Ha16	Frost protection		By probe				1: none ¦ 2: by frost-stat ¦ 3: by probe ¦ 4: by probe+frost-stat	I	R/W	-
Ha17	Enable unit On/Off	-								
	By digit input		Yes				0:No¦1:Yes	D	R/W	-
	By BMS		No				0:No¦1:Yes	D	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Ha18	Setpoint from digital input		No	-	0	1	0:No¦1:Yes	D	R/W	-
Ha19	Enable setpoint offset by analog input		No	-	0	1	0:No¦1:Yes	D	R/W	-
	Auxiliary regulation loop		None	-	0	4	0:None, 1…4	I	R/W	-
Ha20	Regulation loop 1									
	Regulation type		Direct	-	0	1	0: direct¦1: inverse	I	R/W	-
	Output type		Modulating+On/Off	-	0	2	0: modulating+on/off ¦ 1: on/off ¦2: modulating	I	R/W	-
	Other management		None	-	0	2	0: none ¦ 1: on with supply fan ¦ 2: force with frost protection	I	R/W	-
Ha21	Regulation loop 2									
	Regulation type		Direct	-	0	1	0: direct¦1: inverse	I	R/W	-
	Output type		Modulating+On/Off	-	0	2	0: modulating+on/off ¦ 1: on/off ¦2: modulating	I	R/W	-
	Other management		None	-	0	2	0: none ¦ 1: on with supply fan ¦ 2: force with frost protection	I	R/W	-
Ha22	Regulation loop 3									
	Regulation type		Direct	-	0	1	0: direct¦1: inverse	I	R/W	-
	Output type		Modulating+On/Off	-	0	2	0: modulating+on/off ¦ 1: on/off ¦2: modulating	I	R/W	-
	Other management		None	-	0	2	0: none ¦ 1: on with supply fan ¦ 2: force with frost protection	I	R/W	-
Ha23	Regulation loop 4									
	Regulation type		Direct	-	0	1	0: direct¦1: inverse	I	R/W	-
	Output type		Modulating+On/Off	-	0	2	0: modulating+on/off ¦ 1: on/off ¦2: modulating	I	R/W	-
	Other management		None	-	0	2	0: none ¦ 1: on with supply fan ¦ 2: force with frost protection	I	R/W	-
Ha24	Protocol									
	pLAN port		pLAN	-	0	21	5: pLAN ¦ 21:Modbus Master(*)	I	R/W	-
	BMS port		BMS	-	0	4	1:BMS ¦ 4:Winload	I	R/W	-
	Field port		Modbus master	-	1	21	1:Belimo ¦ 21:Modbus master	I	R/W	-
Ha25	Modbus Master settings									
	Baudrate		19200	Bit/s	0	4	0: 1200 ¦ 1: 2400 ¦ 2: 4800 3: 9600 ¦ 4: 19200	I	R/W	-
	Stop bit		2	-	1	2		I	R/W	-
	Parity mode		None	-			0:None ¦ 1:Even ¦ 2:Odd	I	R/W	-
	Timeout		300	ms	100	5000		I	R/W	-
Ha26	pCOe number		0	-	0	2		I	R/W	-
	pCOe1 address		3	-	1	5		I	R/W	-
	pCOe2 address		4	-	1	5		I	R/W	-
	Number of serial probe		None		None	6		I	R/W	-
Ha27	Belimo device									
	Number of actuators		0	-	0	8		I	R/W	-
Ha28	Press Enter to configure Belimo actuators→Ha60									
Ha29	Press Enter to configure the VFD									
Ha30	Enable BMS probes and digital inputs		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
	Backup probe 1		None	-	None	Ain10	0: None; 1: Ain1…10: Ain10	I	R/W	-
	Backup probe 2		None	-	None	Ain10	0: None; 1: Ain1…10: Ain10	I	R/W	-
	Backup probe 3		None	-	None	Ain10	0: None; 1: Ain1…10: Ain10	I	R/W	-
	Backup probe 4		None	-	None	Ain10	0: None; 1: Ain1…10: Ain10	I	R/W	-
Ha31	Press Enter to configure serial probes → Ha91									
Ha39	Enable VFD: (Modbus protocol)						No¦ Yes	D	R/W	
Ha40	Supply VFD									
	Address		1	-	0	999		I	R/W	-
	Data address		0	-	0	9999		I	R/W	-
	Data value		0	-	-32768	32767		I	R/W	-
	Default install (*) for pCO³ built-in		N		No	Yes	0:N=No ¦ 1:Y=Yes	D	R/W	

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Ha41	Supply VFD									
	Control place		I/O terminal	-	1	3	1: I/O terminal ¦ 2:keypad ¦ 3: Fieldbus	I	R/W	-
	Speed reference type		Ain1	-	0	5	0:Ain1 ¦ 1:Ain2 ¦ 2:Keypad ¦ 3: Fieldbus¦ 4: Motor potentiometer ¦5:PID regulation	I	R/W	-
	Rotation type		Clockwise	-	0	1	0:Clockwise ¦ 1: Counter-clockwise	D	R/W	-
Ha42	Supply VFD									
	Motor control mode		Frequency	-	0	1	0:Frequency ¦ 1:Speed	I	R/W	-
	Start function		Ramp	-	0	1	0:Ramp ¦ 1: Flying start	I	R/W	-
	Stop function		Coasting	-	0	1	0:Coasting ¦ 1:Ramp	I	R/W	-
Ha43	Supply VFD									
	Action when in fault: #03;#09;#11;#15		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-
Ha44	Supply VFD									
	Action when in fault: #16;#17;#29;#50		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-
Ha45	Supply VFD									
	Action when in fault: #53;#54		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-
	#55		none	-	0	4	0:None ¦ 1:Warning (below limit)¦ 2:Warning (above limit) ¦ 3: Fault (below limit ¦ 4: Fault (above limit)	I	R/W	-
Ha46	Supply VFD: motor parameters									
	Volt		0	V	180	690		I	R/W	-
	Cosfi		0.0	-	0,30	0,99		I	R/W	-
	Frequency		0	Hz	30	320		A	R/W	-
	Speed		0	rpm	300	20000		I	R/W	-
	Current		0	A	-999,9	999,9		A	R/W	-
	Current limit		0	A	0	999,9		A	R/W	-
Ha50	Return VFD									
	Address		2	-	0	999		I	R/W	-
	Data address		0	-	0	9999		I	R/W	-
	Data value		0	-	-32768	32767		I	R/W	-
	Default install		N		N	S	0:N=No¦ 1:S=Yes	D	R/W	-
Ha51	Return VFD									
	Control place		I/O terminal	-	1	3	1: I/O terminal ¦ 2:keypad ¦ 3: Fieldbus	I	R/W	-
	Speed reference type		Ain1	-	0	5	0:Ain1 ¦ 1:Ain2 ¦ 2:Keypad ¦ 3: Fieldbus¦ 4: Motor potentiometer ¦5:PID regulation	I	R/W	-
	Rotation type		Clockwise	-	0	1	0:Clockwise ¦ 1: Counter-clockwise	D	R/W	-
Ha52	Return VFD									
	Motor control mode		Frequency	-	0	1	0:Frequency ¦ 1:Speed	I	R/W	-
	Start function		Ramp	-	0	1	0:Ramp ¦ 1: Flying start	I	R/W	-
	Stop function		Coasting	-	0	1	0:Coasting ¦ 1:Ramp	I	R/W	-
Ha53	Return VFD									
	Action when in fault: #03;#09;#11;#15		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-
Ha54	Return VFD									
	Action when in fault: #16;#17;#29;#50		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-
Ha55	Return VFD									
	Action when in fault: #53;#54		none	-	0	3	0:None ¦ 1:Warning ¦ 2:Fault stop function ¦ 3: Fault coasting	I	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
	#55		none	-	0	4	0:None ¦ 1:Warning (below limit)¦ 2:Warning (above limit) ¦ 3: Fault (below limit ¦ 4: Fault (above limit)	I	R/W	-
Ha56	Return VFD: motor parameters									
	Volt		0	V	180	690		I	R/W	-
	Cosfi		0.0	-	0,30	0,99		I	R/W	-
	Frequency		0	Hz	30	320		A	R/W	-
	Speed		0	rpm	300	20000		I	R/W	-
	Current		0	A	-999,9	999,9		A	R/W	-
	Current limit		0	A	0	999,9		A	R/W	-
	Belimo 1…Belimo 8									
Ha60 Ha63 Ha66 Ha69 Ha72	Actuator type		None	-	0	9	0-1: None ¦ 2: Air actuator ¦ 3,4: Valve actuator¦ 5: None ¦ 6: Firesmoke damper ¦ 7: None ¦ 8: VAV actuator¦ 9: None	I	R/W	-
Ha75	Addressing mode		Manual	-	0	1	0: Manual ¦ 1: Auto	D	R/W	-
Ha78	SN: 00000-00000-000-000		0	-	0	9		I	R/W	-
Ha81	Address actuator	Enable addressing	No	-	0	1	0:No¦ 1:Yes	D	R/W	
Ha61	Enable external input/probe		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
Ha64 Ha67	Type		NTC	-			0:NTC ¦ 2:0…1V ¦ 3:0…10V ¦ 5: ON/OFF	I	R/W	-
Ha70	Min value		0	-	-999.9	Max		A	R/W	-
Ha73 Ha76 Ha79 Ha82	Max value		0	-	Min	999.9		A	R/W	-
Ha62	Position or air flow limits									
Ha65	Minimum		0	%	0	Lim_max		A	R/W	-
Ha68 Ha71 Ha74 Ha77 Ha80 Ha83	Maximum		0	%	Lim_min	100		A	R/W	-
Ha91	Serial probe n°1…6									
…	Address		128	-	128	159		I	R/W	-
Ha96	Type		Temperature	-	0	1	0:Temperature ¦ 1: Temperature+humidity	D	R/W	-
	Default installation		No	-	No	Yes	0:No¦ 1:Yes	D	R/W	-
b.	**I/O Configuration**									
	Analog input									
Hb01	Supply temperature									
	Position		--	-	0	99		I	R/W	-
	Type		NTC	-	0	4	0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-
Hb02	Return temperature									
	Position		--	-	0	99		I	R/W	-
	Type		NTC	-	0	4	0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb03	External temperature									
	Position		--	-	0	99		I	R/W	-
	Type		NTC	-	-	-	0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-
Hb04	Room temperature									
	Position		--	-	0	99		I	R/W	-
	Type		NTC	-	-	-	0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-
Hb05	Supply humidity									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			%U.R.	0	Max limit		I	R/W	-
	Max limit			%U.R.	Min limit	100		I	R/W	-
Hb06	Return humidity									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			%U.R.	0	Max limit		I	R/W	-
	Max limit			%U.R.	Min limit	100		I	R/W	-
Hb07	External humidity									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			%U.R.	0	Max limit		I	R/W	-
	Max limit			%U.R.	Min limit	100		I	R/W	-
Hb08	Room humidity									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			%U.R.	0	Max limit		I	R/W	-
	Max limit			%U.R.	Min limit	100		I	R/W	-
Hb09	Supply pressure position									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			Pa	0	Max limit		I	R/W	-
	Max limit			Pa	Min limit	100		I	R/W	-
Hb10	Return pressure position									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit			Pa	0	Max limit		I	R/W	-
	Max limit			Pa	Min limit	100		I	R/W	-
Hb11	Frost temperature position									
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb12	Off-coil temperature									
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	I	R/W	-
	Min limit		0	°C	-50	Max limit		A	R/W	-
	Max limit		0	°C	Min limit	200		A	R/W	-
Hb13	CO2 air quality									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	ppm	0	Max limit		A	R/W	-
	Max limit		2000	ppm	Min limit	5000		A	R/W	-
Hb14	VOC air quality position									
	Position		--	-	0	99		I	R/W	-
	Type						2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb15	Exhaust temperature									
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb16	Cooling coil water temperature	Ha06, Ha09, Hc11								
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb17	Preheat coil water temperature	Ha05, Ha09, Hc09								
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb18	Reheating coil water temperature	Ha08, Ha09, Hc16								
	Position		--	-	0	99		I	R/W	-
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA	A	R/W	-
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb19	Regulation probe loop 1									
	Position		--	-	0	99				
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA			
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb20	Regulation probe loop 2									
	Position		--	-	0	99				
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA			
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb21	Regulation probe loop 3									
	Position		--	-	0	99				
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA			
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb22	Regulation probe loop 4									
	Position		--	-	0	99				
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA			
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Hb23	Temperature setpoint offset	Enable:Ha19								
	Position		--	-	0	99				
	Type						0:NTC ¦ 1:Pt1000 ¦ 2:0…1V ¦ 3:0…10V ¦ 4:4…20mA			
	Min limit		0	%	0	Max limit		A	R/W	-
	Max limit		100	%	Min limit	100		A	R/W	-
Digital inputs										
Hb24	Remote On-Off									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Summer/winter									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Double setpoint	Ha18								
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb25	Generic alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Serious alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Frost-stat	Enable:Ha16								
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb26	1st Supply air filter									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	2nd Supply air filter									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Return air filter									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb27	Supply flow									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Return flow									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-

Mask Index	Display description	Description/notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb28	Humidifier alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Inverter supply fan alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Inverter return fan alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb29	Supply fan overload									
	1.Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	2.Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Return fan overload									
	1.Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	2.Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb30	Cool pump 1 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Preheat pump 1 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Reheat pump 1 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb31	Cool pump 2 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Preheat pump 2 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Reheat pump 2 overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb32	Cooling flow alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Preheating flow alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Reheating flow alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb33	Heat recovery clogged									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Preheating heaters overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Reheating heaters overload									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb34	Filter clogged									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Door switch									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Fire and smoke alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Digital outputs										
Hb35	Supply fan									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Return fan									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	On/Off humidifier									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb36	Supply fan 2nd									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
	Return fan 2nd									
	Position		--	-	0	99		I	R/W	-
	Logic		NC	-	-	-	NC, NO	D	R/W	-
Hb37	Star – Delta logic									
	Supply fan - Line		--	-	0	16		I	R/W	-
	Supply fan - Star		--	-	0	16		I	R/W	-
	Supply fan - Delta		--	-	0	16		I	R/W	-
Hb38	Return fan - Line		--	-	0	16		I	R/W	-
	Return fan - Star		--	-	0	16		I	R/W	-
	Return fan - Delta		--	-	0	16		I	R/W	-
Hb39	Fresh air damper									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Bypass damper									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Run around coil	Ha14: run around coil								
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Rotary recovery	Ha14: rotary recovery on/off								
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb40	Global alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Serious alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Minor alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb41	Unit status									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Filter alarm									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Recovery heater									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb42	Cool/heat									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb43	Cool – Cool/heat pump 1									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Preheat pump 1									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Reheat pump 1									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb44	Cool – Cool/heat pump 2									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Preheat pump 2									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Reheat pump 2									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb45	Cool - Cool/heat floating valve open									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Preheating floating valve open									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Reheating floating valve open									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb46	Cool - Cool/heat floating valve close									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Preheating floating valve close									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Reheating floating valve close									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb47	Cooling – cool/heat step 1									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Cooling – cool/heat step 2									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	Cooling – cool/heat step 3									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
Hb48	Preheating heaters									
	1									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	2									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	3									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-
	4									
	Position		--	-	0	99		I	R/W	-
	Logic		NO	-	-	-	NC, NO	D	R/W	-

Mask Index	Display description		Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hb49	Reheating heaters										
	1										
	Position			--	-	0	99		I	R/W	-
	Logic			NO	-	-	-	NC, NO	D	R/W	-
	2										
	Position			--	-	0	99		I	R/W	-
	Logic			NO	-	-	-	NC, NO	D	R/W	-
	3										
	Position			--	-	0	99		I	R/W	-
	Logic			NO	-	-	-	NC, NO	D	R/W	-
	4										
	Position			--	-	0	99		I	R/W	-
	Logic			NO	-	-	-	NC, NO	D	R/W	-
Hb50	Regulation loop on/off										
	1	Position		--	-	0	99		I	R/W	-
		Logic		NO	-	-	-	NC, NO	D	R/W	-
	2	Position		--	-	0	99		I	R/W	-
		Logic		NO	-	-	-	NC, NO	D	R/W	-
	3	Position		--	-	0	99		I	R/W	-
		Logic		NO	-	-	-	NC, NO	D	R/W	-
	4	Position		--	-	0	99		I	R/W	-
		Logic		NO	-	-	-	NC, NO	D	R/W	-
Analog output											
Hb51	Supply fan										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb52	Return fan position										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb53	Fresh air damper										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb54	Mixing damper										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb55	Exhaust damper										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb56	Bypass damper										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb57	Humidifier position										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb58	Preheating valve position										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb59	Cooling – Cool/heat valve position										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-
Hb60	Modulating preheating heaters										
	Position			--	-	0	99		I	R/W	-
	Minimum			0	V	0	Maximum		A	R/W	-
	Maximum			0	V	Minimum	10		A	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value descript.	Type	R/W	CAREL Address
Hb61	Reheating valve									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb62	Modulating reheaters position									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb63	Rotary recovery									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb64	Regulation loop 1									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb65	Regulation loop 2									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb66	Regulation loop 3									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb67	Regulation loop 4									
	Position		--	-	0	99		I	R/W	-
	Minimum		0	V	0	Maximum		A	R/W	-
	Maximum		0	V	Minimum	10		A	R/W	-
Hb99	Positions delete									
	Digital inputs		No	-	0	1	0:No¦ 1:Yes	D	R/W	-
	Analog inputs		No	-	0	1	0:No¦ 1:Yes	D	R/W	-
	Digital outputs		No	-	0	1	0:No¦ 1:Yes	D	R/W	-
	Analog outputs		No	-	0	1	0:No¦ 1:Yes	D	R/W	-
c. Factory settings										
Hc01	Main regulation probe selection									
	Temperature		Return				0:Return ¦ 1:Supply ¦ 2:Room	I	R	-
	Humidity		Return				0:Return ¦ 1:Supply ¦ 2:Room	I	R	-
Hc02	Dampers limits setting									
	Fresh air damper			%	0	100		A	R/W	-
	Min			%	0	100		A	R/W	-
	Max			%	30	100		A	R/W	-
	Mixing damper									
	Min			%	0	100		A	R/W	-
	Max			%	0	100		A	R/W	-
Hc03	Damper settings									
	Coil start delay when freecooling/freeheating active		0	min	0	120		I	R/W	-
	Opening time		120	s	0	9999		I	R/W	-
	Closing delay		120	s	0	9999		I	R/W	-
Hc04	Fans Star-Delta timing									
	Star - Line		2000	ms	0	99990		I	R/W	-
	Star		5000	ms	0	99990		I	R/W	-
	Star - Delta		500	ms	0	99990		I	R/W	-
Hc05	Flow alarm threshold	Ha04: Air flow from: transducer								
	Supply		100	Pa	0	9999		I	R/W	-
	Return		100	Pa	0	9999		I	R/W	-
	Differential		300	Pa	0	9999		I	R/W	-
Hc06	Fans timing	Ha03: Fan type: On/Off (Backup fan)								
	Stop delay		30	s	0	999		I	R/W	-
	Supply - Return		0	s	0	999		I	R/W	-
	Fan1-Fan2 delay		5	s	0	999		I	R/W	-
	Rotation time		0	h	0	999		I	R/W	-
	Overworking time		0	s	-99	99		I	R/W	-
Hc07	Fans flow alarm									
	Start-up delay		20	s	1	999		I	R/W	-
	Running delay		5	s	1	999		I	R/W	-
	Flow warning retries		0	-	0	5		I	R/W	-

Mask Index	Display description	Description / notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hc08	Preheating coil									
	Floating valve running time		180	s	1	3200		I	R/W	-
Hc09	Enable preheating coil water temperature threshold		No	-	No	Yes	0:No¦1:Yes	I	R/W	-
	Threshold		25	°C	-99,	99,		A	R/W	-
	Differential		2	°C	0	9,		A	R/W	-
Hc10	Cooling coil									
	Floating valve running time		180	s	1	3200		I	R/W	-
Hc11	Enable cooling coil water temperature threshold		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
	Threshold		35	°C	-99.9	99.9		A	R/W	-
	Differential		2	°C	0	9.9		A	R/W	-
Hc12	Delay between cooling/heating change		10	min	0	999		I	R/W	-
Hc13	Heat/cool									
	Floating valve running time		180	s	1	3200		I	R/W	-
Hc14	Enable heat/cool coil water temperature threshold		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
	Hot threshold		25	°C	0	99.9		A	R/W	-
	Cool threshold		35	°C	0	99.9		A	R/W	-
	Differential		2	°C	0	9.9		A	R/W	-
Hc15	Reheating coil									
	Floating valve running time		180	s	0	3200		I	R/W	-
Hc16	Enable reheating coil water temperature threshold		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
	Threshold		25	°C	-99,	99,		A	R/W	-
	Differential		2	°C	0	9,		A	R/W	-
Hc17	Pumps									
	Alarm flow delay									
	Startup		30	s	1	999		I	R	-
	Running		15	s	1	999		I	R	-
	Pumps rotation time		96	hour	0	999		I	R/W	-
	Overwork time		0	s	-99	99		I	R/W	-
Hc18	Heat recovery									
	Defrost delay									
	Start		120	s	0	999		I	R/W	-
	End		60	s	0	999		I	R/W	-
	Clogged alarm delay		60	s	0	300		I	R/W	-
Hc19	Air quality									
	Integral time		300	s	0	9999		I	R/W	-
	Cleaning time		10	min	0	300		I	R/W	-
Hc20	Generic alarm input delay		0	s	0	9999		I	R/W	-
	Disable buzzer		No	-	-	-	0:No¦1:Yes	D	R/W	-
	Enable clock board		No	-	-	-	0:No¦1:Yes	D	R/W	-
Hc40	Supply VFD									
	Volt at 0 Hz		0	%	0	40		A	R/W	-
	Switch frequency		0	kHz	1	16		A	R/W	-
	V/f curve midpoint									
	Voltage		0	%	0	100		A	R/W	-
	Frequency		0	Hz	0	320		A	R/W	-
Hc41	Supply VFD									
	V/f ratio		Linear				0:Linear ¦ 1:Squared ¦ 2:Programmable ¦ 3:Linear with flux optimisation	I	R/W	-
	V/f Optimisation		Not used				0:Not used ¦ 1:Automatic boost	I	R/W	-
	Auto restart		Not used				0:Not used ¦ 1:used	I	R/W	-
Hc42	Supply VFD									
	Min frequency		0	Hz	0	Max frequency		A	R/W	-
	Max frequency		50	Hz	Min frequency	320		A	R/W	-
	Acceleration time		1	s	0.1	3200		A	R/W	-
	Deceleration time		1	s	0.1	3200		A	R/W	-
Hc50	Return VFD									
	Volt at 0 Hz		0	%	0	40		A	R/W	-
	Switch frequency		0	kHz	1	16		A	R/W	-
	V/f curve midpoint									
	Voltage		0	%	0	100		A	R/W	-
	Frequency		0	Hz	0	320		A	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
Hc51	Return VFD									
	V/f ratio		Linear				0:Linear ¦ 1:Squared ¦ 2:Programmable ¦ 3:Linear with flux optimisation	I	R/W	-
	V/f Optimisation		Not used				0:Not used ¦ 1:Automatic boost	I	R/W	-
	Auto restart		Not used				0:Not used ¦ 1:used	I	R/W	-
Hc52	Return VFD									
	Min frequency		0	Hz	0	Max frequency		A	R/W	-
	Max frequency		50	Hz	Min frequency	320		A	R/W	-
	Acceleration time		1	s	0.1	3200		A	R/W	-
	Deceleration time		1	s	0.1	3200		A	R/W	-
d. Inizialization										
Hd01	Save configuration		No	-	No	Yes	0:No¦1:Yes	D	R/W	-
Hd02	Default installation Erase user settings and install global default values		No	-	-	-	0:No¦1:Yes	I	R/W	-
Hd03	Insert new manufacture password (PW2)		1234	-	0	9999		I	R/W	-
e. Input/output test										
He01	Digital output									
	Supply fan		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Supply fan 2		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Return fan		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Return fan 2		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He02	Digital output									
	Supply fan line		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Supply fan star		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Supply fan delta		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Return fan line		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Return fan star		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Return fan delta		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He03	Digital output									
	Unit status		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Humidifier		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Rotary recovery/ run around coil		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He04	Digital output									
	Global alarm		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Serious alarm		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Minor alarm		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Filter alarm		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He05	Digital output									
	Fresh air damper		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Bypass damper		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheater 1		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheater 2		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheater 3		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheater 4		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He06	Digital output									
	Pre heater 1		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Pre heater 2		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Pre heater 3		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Pre heater 4		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He08	Digital output									
	Pump 1									
	Cooling – Cool/heat		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Preheating		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheating		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He09	Digital output									
	Pump 2									
	Cooling – Cool/heat		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Preheating		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheating		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-

Mask Index	Display description	Description/ notes	Def.	UOM	Min	Max	Value description	Type	R/W	CAREL Address
He10	Digital output									
	Cooling – Cool/heat floating valve open		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Cooling – Cool/heat floating valve close		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Preheating floating valve open		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Preheating floating valve close		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheating floating valve open		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Reheating floating valve closed		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He11	Digital output									
	Regulation loop 1		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Regulation loop 2		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Regulation loop 3		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
	Regulation loop 4		Auto	-	Auto	On	0:Auto ¦ 1:Off ¦ 2:On	I	R/W	-
He12	Analog output									
	Supply fan		Auto	-	0	100	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Return fan		Auto	-	0	100	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Exhaust damper		Auto	-	0	100	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Fresh air damper		Auto	-	0	100	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Mixing damper		Auto	-	0	100	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
He13	Analog output									
	Bypass damper		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Rotary recovery		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Preheat heater		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Reheat heater		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
He14	Analog output									
	Valve									
	Cooling – Cool/heat		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Preheating		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Reheating		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
He15	Analog output									
	Regulation loop 1		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Regulation loop 2		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Regulation loop 3		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
	Regulation loop 4		Auto	-	0	101	0:Auto ¦ 1:0% ¦ 101:100%	I	R/W	-
He40	Supply VFD									
	Require		0	%	0	100		A	R/W	-
	Force VFD		Stop	-	Stop	Run	0: Stop ¦ 1: Run	D	R/W	-
He50	Return VFD									
	Require		0	%	0	100		A	R/W	-
	Force VFD		Stop	-	Stop	Run	0: Stop ¦ 1: Run	D	R/W	-

10 ALARMS

10.1 Types of alarms

For configuration of the alarms see paragraph 6.1.1.

Input alarms: generic (shuts down the unit), serious (stops the unit immediately).

Output alarms: general (minor+serious), minor (see table of alarms), serious (see table of alarms) and filters (supply 1 +supply 2 +return +filters). There are three types of alarms:

• with manual reset;

• with automatic reset: the alarm is resets and the unit restarts automatically when the alarm condition has been resolved;

• with semiautomatic reset: reset is automatic but the alarm signal remains active.

When an alarm occurs, the bell button flashes with a red light and the buzzer sounds. To mute the buzzer, press the bell button, while to reset the alarms press and hold the bell button for 3 s.

10.2 Alarm log

The 50 most recent alarms are saved in a FIFO alarm log. The last alarm activated is added to the bottom of the alarm log. To access the log, from the standard display:

Alarm button →Enter→ Alarm log

The screen displays the alarm code, description and readings of the supply and return probes at the moment the alarm was activated.

Key

1	Supply probe	2	Return probe

10.3 Alarm table

Code	Description	Type of reset	Effect on control	Serious alarm (G)/Minor (L)
A01	Supply temperature probe	Automatic	Stop temperature limit function, stop reheating if Sreg=return	Serious
A02	Return temperature probe	Automatic	Stop set point compensation function and heat recovery	Serious
A03	Outside temperature sensor	Automatic	Stop set point compensation function and heat recovery	Minor
A04	Humidity probe supply	Automatic	Stop humidity limit function	Serious
A05	Return humidity probe	Automatic	Stop heat recovery by enthalpy, freecooling by enthalpy, if return probe= Sreg → stop unit	Serious
A06	Outside humidity probe	Automatic	Stop freecooling/ freeheating and heat recovery by enthalpy functions	Minor
A07	Supply pressure probe	Automatic	Stop individual fan or unit as per parameter Ha04	Serious
A08	Return pressure probe fault	Automatic	Stop individual fan or unit as per parameter Ha04	Serious
A09	Frost protection temperature probe	Automatic	Shutdown unit	Serious
A10	Saturated temperature probe	Automatic		Minor
A11	Air quality probe (CO2)	Automatic	Fan at MAX and outside damper open at MAX	Minor
A12	Air quality probe (VOC)	Automatic	Fan at MAX and outside damper open at MAX	Minor
A13	Exhaust temperature probe	Automatic	Stop heat recovery function if frost protection control on exhaust probe	Minor
A14	Cooling or heat/cool coil temperature probe	Automatic	Deactivate coil	Minor
A15	Preheating coil temperature probe fault	Automatic	Deactivate coil	Minor
A16	Reheating coil temperature probe fault	Automatic	Deactivate coil	Minor
A17	Auxiliary probe 1	Automatic	Stop auxiliary control loop 1	Minor
A18	Auxiliary probe 2	Automatic	Stop auxiliary control loop 2	Minor
A19	Auxiliary probe 3	Automatic	Stop auxiliary control loop 3	Minor
A20	Auxiliary probe 4	Automatic	Stop auxiliary control loop 4	Minor
A21	Room temperature probe fault	Automatic	Stop room protection	Minor
A22	Room humidity probe	Automatic		Minor
A23	Analogue input probe offset	Automatic	Eliminate offset	Minor
A24	Control probe fault	Automatic	Shutdown unit	Serious
B01	Dirty heat recovery unit alarm	Automatic	Stop heat recovery function	Minor
B02	Reheating heaters thermal overload alarm	Manual	Shutdown unit	Serious
B03	Preheating heaters thermal overload alarm	Manual	Shutdown unit	Serious

B04	Cooling coil inlet limit alarm	Automatic	Deactivate coil (after 10 min)	Serious
B05	Preheat coil inlet limit alarm	Automatic	Deactivate coil (after 10 min)	Serious
B06	Reheat coil inlet limit alarm	Automatic	Deactivate coil (after 10 min)	Serious
B07	Heat / cool coil inlet limit alarm	Automatic	Deactivate coil (after 10 min)	Serious
E11	pCOe 1 offline	Semiautomatic	Shutdown unit	Serious
E12	Incorrect probe 1, 2 configuration on pCOe 1	Automatic	Immediately stop unit	Serious
E13	Incorrect probe 3, 4 configuration on pCOe 1	Automatic	Immediately stop unit	Serious
E21	pCOe 2 offline	Semiautomatic	Shutdown unit	Serious
E22	Incorrect probe 1, 2 configuration on pCOe 2	Automatic	Immediately stop unit	Serious
E23	Incorrect probe 3, 4 configuration on pCOe 2	Automatic	Immediately stop unit	Serious
F01	Supply 1 flow alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop supply fan and control devices	Serious
F02	Return 1 flow alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop return fan	Serious
F03	Supply 2 flow alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop supply fan and control devices	Serious
F04	Return 2 flow alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop return fan	Serious
F05	Supply fan 1 overload	Manual	Stop all control devices on supply	Serious
F06	Return fan 1 overload	Manual	**Ha04** / **effect** global / total shutdown individual / stop return fan	Serious
F07	Supply inverter alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop supply fan and control devices	Serious
F08	Return inverter alarm	Manual	**Ha04** / **effect** global / total shutdown individual / stop return fan	Serious
F09	Supply fan 2 overload	Manual	Stop all control devices on supply	Serious
F10	Return fan 2 overload	Manual	**Ha04** / **effect** global / total shutdown individual / stop return fan	Serious
F11	Supply 1 flow warning	Automatic	Perform number of attempts set on Hc07	Minor
F12	Supply 2 flow warning	Automatic	Perform number of attempts set on Hc07	Minor
F13	Return 1 flow warning	Automatic	Perform number of attempts set on Hc07	Minor
F14	Return 2 flow warning	Automatic	Perform number of attempts set on Hc07	Minor
G01	Clock fault	Manual	Stop time bands, maintains last operating mode	Minor
G02	Extended memory fault	Manual	Deactivate load default parameters Ha96	Minor
G03	Frost protection alarm AIN	Automatic	Stop fans, close dampers, activate preheating coil at 100%, and cooling coil at 50%, all pumps on	Minor
G04	Frost protection alarm DIN	Automatic		Minor
G05	Low room temperature protection	Automatic	Control operates as if it were ON	Minor
H01	Humidifier alarm	Manual	Stop humidification function	Serious
M11	Belimo 1 Offline	Semiautomatic	Immediately stop unit	Serious
M12	Belimo 1 probe fault	Semiautomatic	Depends on probe function	Minor
M13	Belimo 1 Fire/Smoke	Manual	Immediately stop unit	Serious
M21	Belimo 2 Offline	Semiautomatic	Immediately stop unit	Serious
M22	Belimo 2 probe fault	Semiautomatic	Depends on probe function	Minor
M23	Belimo 2 Fire/Smoke	Manual	Immediately stop unit	Serious
M31	Belimo 3 Offline	Semiautomatic	Immediately stop unit	Serious
M32	Belimo 3 probe fault	Semiautomatic	Depends on probe function	Minor
M33	Belimo 3 Fire/Smoke	Manual	Immediately stop unit	Serious
M41	Belimo 4 Offline	Semiautomatic	Immediately stop unit	Serious
M42	Belimo 4 probe fault	Semiautomatic	Depends on probe function	Minor

Code	Description on display	Type of reset	Effect on control	Serious alarm (G)/Minor (L)
M43	Belimo 4 Fire/Smoke	Manual	Immediately stop unit	Serious
M51	Belimo 5 Offline	Semiautomatic	Immediately stop unit	Serious
M52	Belimo 5 probe fault	Semiautomatic	Depends on probe function	Minor
M53	Belimo 5 Fire/Smoke	Manual	Immediately stop unit	Serious
M61	Belimo 6 Offline	Semiautomatic	Immediately stop unit	Serious
M62	Belimo 6 probe fault	Semiautomatic	Depends on probe function	Minor
M63	Belimo 6 Fire/Smoke	Manual	Immediately stop unit	Serious
M71	Belimo 7 Offline	Semiautomatic	Immediately stop unit	Serious
M72	Belimo 7 probe fault	Semiautomatic	Depends on probe function	Minor
M73	Belimo 7 Fire/Smoke	Manual	Immediately stop unit	Serious
M81	Belimo 8 Offline	Semiautomatic	Immediately stop unit	Serious
M82	Belimo 8 probe fault	Semiautomatic	Depends on probe function	Minor
M83	Belimo 8 Fire/Smoke	Manual	Immediately stop unit	Serious
O01	BMS offline alarm	Automatic	Replace BMS probes with backup probes	Serious
P01	Cooling pump 1 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P02	Cooling pump 2 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P03	Cooling pump 1 flow alarm	Manual	Depends on the no. of pumps	Serious
P04	Cooling pump 2 flow alarm	Manual	Depends on the no. of pumps	Serious
P05	Cooling pump 1 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
P06	Cooling pump 2 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
P07	Preheating pump 1 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P08	Preheating pump 2 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P09	Preheating pump 1 flow alarm	Manual	Depends on the no. of pumps	Serious
P10	Preheating pump 2 flow alarm	Manual	Depends on the no. of pumps	Serious
P11	Preheating pump 1 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
P12	Preheating pump 2 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
P13	Reheating pump 1 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P14	Reheating pump 2 flow warning	Automatic	Perform number of attempts set on Ha10	Minor
P15	Reheating pump 1 flow alarm	Manual	Depends on the no. of pumps	Serious
P16	Reheating pump 2 flow alarm	Manual	Depends on the no. of pumps	Serious
P17	Reheating pump 1 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
P18	Reheating pump 2 thermal overload alarm	Manual	Depends on the no. of pumps	Serious
S11	Serial humidity probe 1 fault	Semiautomatic		Minor
S12	Serial probe 1 offline	Semiautomatic		Minor
S13	Serial temperature probe 1 fault	Semiautomatic		Minor
S21	Serial humidity probe 2 fault	Semiautomatic		Minor
S22	Serial probe 2 offline	Semiautomatic		Minor
S23	Serial temperature probe 2 fault	Semiautomatic		Minor
S31	Serial humidity probe 3 fault	Semiautomatic		Minor
S32	Serial probe 3 offline	Semiautomatic		Minor
S33	Serial temperature probe 3 fault	Semiautomatic		Minor
S41	Serial humidity probe 4 fault	Semiautomatic		Minor
S42	Serial probe 4 offline	Semiautomatic		Minor
S43	Serial temperature probe 4 fault	Semiautomatic		Minor
S51	Serial humidity probe 5 fault	Semiautomatic		Minor
S52	Serial probe 5 offline	Semiautomatic		Minor
S53	Serial temperature probe 5 fault	Semiautomatic		Minor
S61	Serial humidity probe 6 fault	Semiautomatic		Minor
S62	Serial probe 6 offline	Semiautomatic		Minor
S63	Serial temperature probe 6 fault	Semiautomatic		Minor
T01	Humidifier maintenance warning	Manual	Reset service hours (Gf*)	Minor
T02	Supply fan 1 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T03	Return fan 1 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T04	Cooling pump 1 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T05	Cooling pump 2 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T06	Preheating pump 1 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T07	Preheating pump 2 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T08	Preheating pump 1 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T09	Preheating pump 2 maintenance warning	Manual	Reset service hours (Gf*)	Minor
T10	Reheat heater 1 warning	Manual	Reset service hours (Gf*)	Minor
T11	Reheat heater 2 warning	Manual	Reset service hours (Gf*)	Minor
T12	Reheat heater 3 warning	Manual	Reset service hours (Gf*)	Minor

Code	Description on display	Type of reset	Effect on control	Serious alarm (G)/Minor (L)
T13	Heat wheel warning	Manual	Reset service hours (Gf*)	Minor
T14	Warning supply fan 2 maintenance	Manual	Reset service hours (Gf*)	Minor
T15	Warning return fan 2 maintenance	Manual	Reset service hours (Gf*)	Minor
T16	Reheat heater 4 warning	Manual	Reset service hours (Gf*)	Minor
T17	Preheat heater 1 warning	Manual	Reset service hours (Gf*)	Minor
T18	Preheat heater 2 warning	Manual	Reset service hours (Gf*)	Minor
T19	Preheat heater 3 warning	Manual	Reset service hours (Gf*)	Minor
T20	Preheat heater 4 warning	Manual	Reset service hours (Gf*)	Minor
U01	Generic alarm from digital input	Automatic	Stop unit	Minor
U02	Serious alarm from digital input	Manual	Stop unit	Serious
U03	Supply filter 1 alarm	Automatic		Minor
U04	Supply filter 2 alarm	Automatic		Minor
U05	Return filter alarm	Automatic		Minor
U06	Smoke/fire alarm	Manual	Immediately stop unit	Serious
U07	Open door alarm	Manual	Immediately stop unit	Serious
U08	Dirty filter alarm	Automatic		Minor
V11	Supply VFD offline	Semiautomatic	Immediately stop unit	Serious
V12	Supply VFD alarms 1-2-3-5	Semiautomatic	**Ha04** / **effect**: global / total shutdown; individual / stop supply fan and control devices	Serious/Minor
V13	Supply VFD alarms 9-11-13-14-15	Semiautomatic		Serious/Minor
V14	Supply VFD alarms 16-17-22-25-29	Semiautomatic		Serious/Minor
V15	Supply VFD alarms 34-40-41-50-51	Semiautomatic		Serious/Minor
V16	Supply VFD alarms 52-53-54-55	Semiautomatic		Serious/Minor
V21	Return VFD offline	Semiautomatic	Immediately stop unit	Serious
V22	Return VFD alarms 1-2-3-5	Semiautomatic	**Ha04** / **effect**: global / total shutdown; individual / stop return fan	Serious/Minor
V23	Return VFD alarms 9-11-13-14-15	Semiautomatic		Serious/Minor
V24	Return VFD alarms 16-17-22-25-29	Semiautomatic		Serious/Minor
V25	Return VFD alarms 34-40-41-50-51	Semiautomatic		Serious/Minor
V26	Return VFD alarms 52-53-54-55	Semiautomatic		Serious/Minor
Z01	No active alarms			
Z02	Alarms reset			

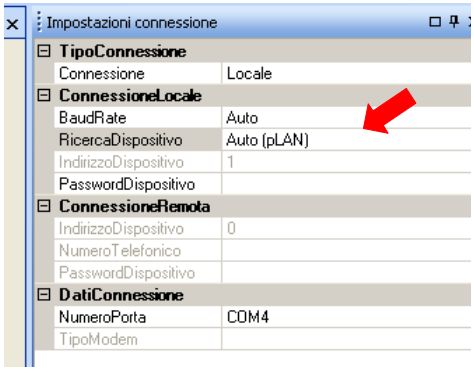
11 pCO Manager

11.1 Installation

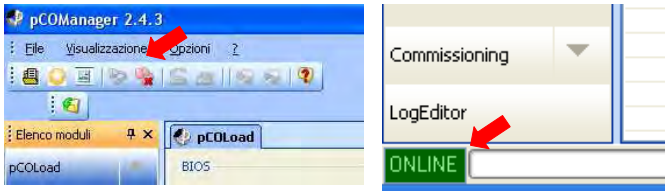
On the http://ksa.carel.com website, under the pCO sistema section, select pCO_manager. After having accepted the general license conditions for free use of the software, a dialogue box is displayed for downloading the pCO_manager.zip file.

11.2 PC – pCO controller connection

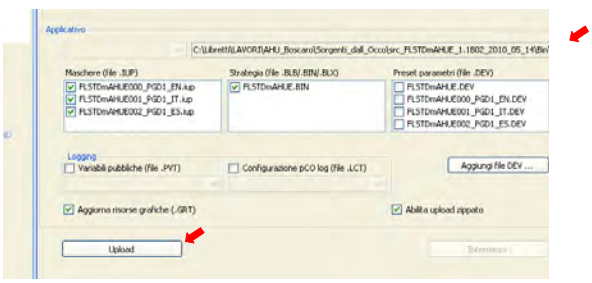
The computer's USB port must be connected via cable to the USB/RS485 converter and this must be connected via a telephone cable to the pLAN port on the pCO.
When opening the pCO_manager program, a screen is shown with the connection settings at the top right. Choose:
1) local connection;
2) baudrate: Auto;
3) search device: Auto (pLAN).
As regards the port number, follow the instructions in the wizard for automatic recognition (e.g. COM4)



Power down the controller and then power up again, click the button to make the connection; once connected the "ONLINE" icon will flash in the bottom left corner.

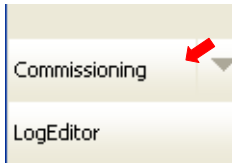


Select the directory where the application files are located and select "Upload" to load the application to the pCO controller.

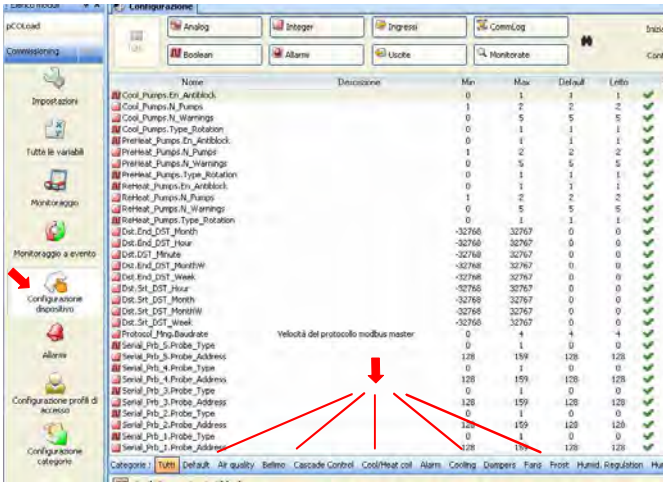


11.3 Commissioning

Use the mouse to select "commissioning" at the bottom left. A new work area will be displayed. Select the directory where the ".2cf" files are located.

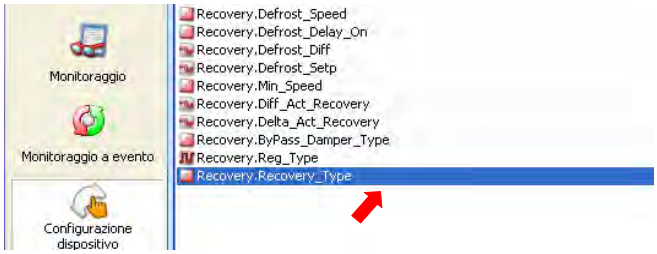


Select the configure device function to show all the application variables. These can be selected based on the categories shown below

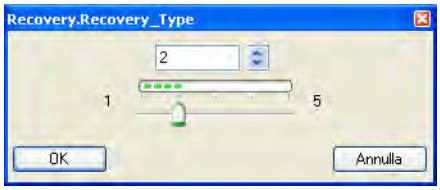


11.3.1 Setting a parameter

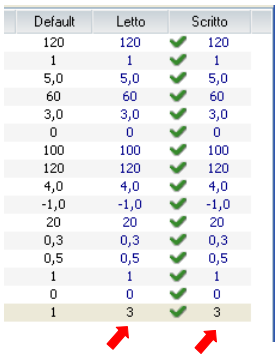
Choose the category of parameters and then the desired parameter: this will be highlighted in blue (e.g. recovery.recovery_type).



To set the parameter:
1) double click the "read" column. A dialogue box is displayed for entering the new value of the parameter.



2) choose the new value (e.g. 3) and then click OK. The new value will be shown in the "written" column. To write the parameter to the pCO controller, press the right mouse button and then select "write selected". The value will be shown in the "written" column as confirmation.



Default	Letto	Scritto
120	120	120
1	1	1
5,0	5,0	5,0
60	60	60
3,0	3,0	3,0
0	0	0
100	100	100
120	120	120
4,0	4,0	4,0
-1,0	-1,0	-1,0
20	20	20
0,3	0,3	0,3
0,5	0,5	0,5
1	1	1
0	0	0
1	3	3

At the end, select "Save" to generate the ".2cw" project file.

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